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ABSTRACT

Proceedings of the Second International Congress on Pharmacy Education, which address the entire pharmacy curriculum, are presented. Contents are as follows: "Educating for the Pharmaceutical Industry," J.N. Banerjee; "Overview on Pharmaceuticals for Developing Countries," Leighton E. Cluff; "Pharmacy and the Third World," Patrick F. D'Arcy; "The United States Pharmaceutical Industry," Lewis A. Engman; "United States Pharmacy Education," Melvin R. Gibson; "United States Pharmacy Practice," Raymond A. Gosselin; "Pharmacists' Key Role in New Drug Development, Testing, and Use," Jere Goyan; "Educating Pharmacists for Institutional Practice in Developing Countries," Marilyn F. Harris; "Forces Affecting Pharmacy Education--An Industry Perspective," William H. Helfand; "Educating Pharmacists for Primary Care Roles," Eric T. Herfindal; "Education for Institutional Practice," Clifford E. Hynniman; "Training Pharmacists for Primary Care in Sweden," Hans H. Linden; "Education for the Pharmaceutical Industry--Some Alternatives," Keith Marshall; "Health Services and Pharmaceuticals: A United States Perspective," Mark Novitch; "Canadian Pharmacy and Primary Care," William A. Parker; "Preparing First Degree Pharmacists for Institutional Practice," Gerald E. Schumacher; "Education for the Pharmaceutical Industry," Robert V. Smith; "Government's Impact on Pharmacy," Nathan Watzman; and "Forces Affecting Pharmacy Education," Harold H. Wolf. Abstracts of contributed papers are appended. (SW)

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# PROCEEDINGS
# of the
# SECOND INTERNATIONAL CONGRESS
# on
# PHARMACY EDUCATION

July 17-20, 1980
Boston, Massachusetts, U.S.A.

Noreen L. Suntrup, Editor

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# TABLE OF CONTENTS

Page

**Planners of the Congress** . . . . . . . . . . . . . . . . . . . . . 1

**Acknowledgements** . . . . . . . . . . . . . . . . . . . . . . . . 2

**History and Objectives** . . . . . . . . . . . . . . . . . . . . . 3

**Foreword** . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5

**General Schedule** . . . . . . . . . . . . . . . . . . . . . . . . 7

**Invited Presentations**

"Educating for the Pharmaceutical Industry" J.N. Banerjee . . . . . 11

"Overview on Pharmaceuticals for Developing Countries" Leighton E. Cluff . . . . . . . . . . . . . . . . . . . 19

"Pharmacy and the Third World" Patrick F. D'Arcy . . . . . . . . . 23

"The United States Pharmaceutical Industry" Lewis A. Engman . . . 29

"United States Pharmacy Education" Melvin F. Gibson . . . . . . . 35

"United States Pharmacy Practice" Raymond A. Gosselin . . . . . . 47

"Pharmacists' Key Role in New Drug Development, Testing, and Use" Jere Goyan . . . . . . . . . . . . . . . . . . . 55

"Educating Pharmacists for Institutional Practice in Developing Countries" Marilyn F. Harris . . . . . . . . . . . 57

"Forces Affecting Pharmacy Education — An Industry Perspective" William H. Helfand . . . . . . . . . . . . . 67

"Educating Pharmacists for Primary Care Roles" Eric T. Herfindal . . . . . . . . . . . . . . . . . . . . 73

"Education for Institutional Practice" Clifford E. Hynniman . . . . 79

"Training Pharmacists for Primary Care in Sweden" Hans H. Lindén . . . . . . . . . . . . . . . . . . . . . 87

"Education for the Pharmaceutical Industry — Some Alternatives" Keith Marshall . . . . . . . . . . . . . . . 97

"Health Services and Pharmaceuticals: A United States Perspective" Mark Novitch . . . . . . . . . . . . . . . 103

"Canadian Pharmacy and Primary Care" William A. Parker . . . . . 107

"Preparing First Degree Pharmacists for Institutional Practice" Gerald E. Schumacher . . . . . . . . . . . . . 113

"Education for the Pharmaceutical Industry" Robert V. Smith . . . . 117

"Government's Impact on Pharmacy" Nathan Watzman . . . . . . . 129

Moderator's opening remarks from Session on Pharmaceuticals for Developing Countries — Lawrence C. Weaver . . . . . . . . 135

"Forces Affecting Pharmacy Education" Harold H. Wolf . . . . . . . 137

Contributed Paper Sessions

1 — John Lach, Presiding . . . . . . . . . . . . . . . . . . . . 145
Nicholas Fiagbe, Presiding . . . . . . . . . . . . . . . . . . 149
Judith T. Barr, Presiding . . . . . . . . . . . . . . . . . . . 153

2 — Mitchell L. Borke, Presiding. . . . . . . . . . . . . . . . . 159
Charles F. Peterson, Presiding . . . . . . . . . . . . . . . . 164
Sumner Robinson, Presiding . . . . . . . . . . . . . . . . . . 169

**Directory of Registered Participants** . . . . . . . . . . . . . . 174

**Order Form for Additional Copies** . . . . . . . . . . . . . . . . 183

## PLANNERS OF THE CONGRESS

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and Allied Health Sciences

Northeastern University College of Pharmacy
and Allied Health Professions

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Donald L. Sorby, Ph.D., President, 1980-81

Christopher A. Rodowskas, Jr., Ph.D., Executive Director

## ACKNOWLEDGEMENTS

The Planning Committee of the Second International Congress on Pharmacy Education and the American Association of Colleges of Pharmacy join together in thanking the following organizations for their generous support of this Congress:

American Foundation for Pharmaceutical Education
Barnes-Hind Pharmaceuticals, Inc.
Berlex Laboratories, Inc.
Ciba Pharmaceutical Company
Geigy Pharmaceuticals
Lederle Laboratories
Eli Lilly and Company
McNeil Laboratories
Merck Sharp & Dohme
Pfizer Pharmaceuticals
Searle Laboratories
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E.R. Squibb & Sons, Inc.
The Upjohn Company
Wyeth Laboratories

The conference organizers are also deeply indebted to the following persons, without whose skills, unstinting efforts, and countless hours of time this endeavor could not have been a success: Raymond A. Gosselin, Sc.D., President, and Benjamin R. Hershenson, Ph.D., Assistant Dean, of Massachusetts College of Pharmacy and Allied Health Sciences; Gerald E. Schumacher, Ph.D., Dean, and Judith T. Barr, M.Ed., Associate Dean, of Northeastern University College of Pharmacy and Allied Health Professions; and Mary B. Bassler, Secretary to the Executive Director, John F. Schlegel, Pharm.D., Assistant Executive Director, and Lars Solander, Ph.D., Director, Office of Educational Research and Development, of the American Association of Colleges of Pharmacy.

Countless others, too numerous to mention by name, were also responsible for the success of this Congress. Not the least of these are the participants themselves, whose contributions to the days' events were a visible and lasting evidence that the will and desire exist to realize the meeting's objectives.

## Second International Congress on Pharmacy Education

## HISTORY AND OBJECTIVES

In 1976, the University of Minnesota College of Pharmacy and the American Association of Colleges of Pharmacy sponsored the First International Congress on Clinical Pharmacy Education. That Congress introduced the clinical concept to pharmacy educators from throughout the world. It was considered a great success. In planning a second International Congress by the AACP, it was thought that the scope of the Congress should include the entire curriculum and not just the clinical component. The program was also conceived on the principle of two-way communication. Its design allows educators from the United States to explain their educational strategies, and it also provides a forum for educators from outside the U.S. to communicate their approaches to pharmacy education. It is hoped that this exchange of ideas can contribute to the improvement of pharmaceutical education throughout the world.

The educational experience was also designed to introduce foreign visitors to the U.S. health care system, the U.S. pharmaceutical industry, U.S. pharmacy practice and U.S. drug regulation. Congress participants also were able to visit the many famous research, educational and health services facilities in the Boston area.

In recent years, the American Association of Colleges of Pharmacy has devoted increasing interest to pharmacy educators outside the United States. The 1976 First International Congress on Clinical Pharmacy Education was very well received, and a portion of the program of the 1978 annual meeting of the Association was devoted to a panel on international pharmacy education.

The objectives of this 1980 Congress were: 1) to provide for an exchange of educational subject matter and 2) to facilitate colleagueal relationships and encourage future collaborative activities.

## FOREWORD

Cecil John Rhodes (1853-1902), in establishing the Rhodes Scholarship, stated, "Educational relations make the strongest tie." Many of us involved in planning, organizing and implementing the Second International Congress on Pharmacy Education subscribe to these sage words, and surely, upon the completion of the Congress, all of us came to have a deep understanding of the meaning of Rhodes' statement and the enormous implications contained therein.

It was the honor and pleasure of the American Association of Colleges of Pharmacy to organize and host this Congress in Boston, Massachusetts, during July 1980. This event coincided with the 350th birthday of the city of Boston, following the Bicentennial celebration of the United States by a mere four years. Mayor Kevin H. White of Boston wrote in a message to the Congress participants that ". . .this congress. . .like Boston herself, is culturally pluralistic and recognizes the expansion of thought and innovation potential that such forums for idea exchange do provide."

Those of us who enthusiastically worked toward the development of this program long ago recognized that the structure and format, as well as the subject matter, involved in pharmacy education around the world represent the specific mix of tradition, unique needs, available resources, economics and political systems of the respective nations where the noble and honorable profession of pharmacy has been and is practiced.

The problem, though, is that many of us have no means of formal — or even informal — intermittent conversation with one another. The initial Congress in 1976 was a success for many reasons, but perhaps the most important factor was that its successful conduct proved beyond any doubt that there is an interest in and need for an international forum for pharmacy educators. Albeit, there are international pharmacy organizations; however, none represents all areas of the world, and few devote effort, attention or resources to the education of future practitioners.

It was hoped that the Second International Congress would attract colleagues from around the world who would be willing to share their experiences, strategies, views and aspirations with one another. Toward this end, the program was an overwhelming success.

Nevertheless, the ultimate success and impact of this Congress will arise not solely from those 300 persons who attended it but also from the countless thousands of others who will be reading this proceedings report and who will be challenged, stimulated, persuaded, or even forced to upgrade their skills and to meet a number of other challenges presented herein. It is our hope and, indeed, our belief that the adjournment of this Congress on July 20 marked not the end, but rather the beginning, of the accomplishment of its objectives. For only if the participants carried back with them to their respective countries and professional environments the spirit and enthusiasm that was so evident throughout the four days of the Congress will the hopes and aspirations contained on the following pages be able to be made a reality.

Even though the Congress' last speaker has spoken and the participants have gone their separate ways, it is the desire of the Congress organizers to facilitate the continuation of exchanges among the participants and to actively support international cooperation among them. Only if the Congress was the beginning of new and continuing international endeavors and relationships will our goals have been truly realized.

Comments and suggestions from the readers of this document are invited, and correspondence among all persons who discover shared interests with others whose ideas appear in this proceedings is encouraged.

Finally, it is the hope of the organizers of this Congress that another organization will recognize the value of continuing this medium of international exchange and will sponsor a Third International Congress on Pharmacy Education in 1984.

Albert I. Wertheimer, Ph.D.
Minneapolis, Minnesota U.S.A.

## GENERAL SCHEDULE

| | |
|---|---|
| **Thursday, July 17** | |
| 4:00 - 7:30 PM | **Registration** |
| 6:00 - 8:00 PM | **Reception** |
| 7:30 PM | **Welcome**<br>Albert I. Wertheimer, Ph.D., Chair<br>Christopher A. Rodowskas, Jr., Ph.D.<br>**Introductory Remarks**<br>Raymond A. Gosselin, Sc.D.<br>Gerald E. Schumacher, Pharm.D., Ph.D. |
| **Friday, July 18** | |
| 8:30 AM | **Health Care Service and Education in the United States**<br>Moderator: Albert I. Wertheimer, Ph.D.<br>"Health Services and Pharmaceuticals: A United States Perspective"<br>Mark Novitch, M.D.<br>"United States Pharmacy Education"<br>Melvin R. Gibson, Ph.D.<br>"United States Pharmacy Practice"<br>Raymond A. Gosselin, Sc.D.<br>"The United States Pharmaceutical Industry"<br>Lewis A. Engman |
| 12:30 PM | **Lunch** |
| 2:00 PM | **Primary Care**<br>Moderator: Albert H. Taubman, Ph.D.<br>"Educating Pharmacists for Primary Care Roles"<br>Eric T. Herfindal, Pharm.D.<br>"Training Pharmacists for Primary Care in Sweden"<br>Hans H. Lindén, M.Sc.<br>"Canadian Pharmacy and Primary Care"<br>William A. Parker, Pharm.D., M.B.A. |
| 4:00 - 6:00 PM | **Contributed Paper Sessions**<br>A. Presiding: John Lach, Ph.D.<br>Presenters:<br>A.A. Ageel, A.A. Al-Badr and A.C. Ellison<br>P. Iwe. Akubue |

D.C. Brodie and William F. McGhan
A. Defalque
Yehia M. Dessouky and Saadeddin El Migirab
Arthur C. Ellison and A.A. Al-Badr
E.H. Froese
Douglas Hancox

B. Presiding: Nicholas Fiagbe, Ph.D.

Presenters:
Liliana Drenovska-Noninska
Weng F. Huang and Chung-Hsiung Chen
El-Sebai A. Ibrahim
Chikataro Kawasaki and Eiichi Akaho
Helmer Kofod
M.L. Lesne
Sahat Lumbantoruan
G.H. Mahran
E. Menczel

C. Presiding: Judith T. Barr, M.S.

Presenters:
T. Myrtes Murad and J.E. Murad
John Ocran
Maria Aparecida Pourchet-Campos
J.S. Qadry
M. Darwish Sayed
Fauzi Sjuib
Barbara Stewart
H.P. Tipnis, A.B. Thakur and C.K. Kokate
Norman Westwood

8:00 - 11:00 PM **Reception**

**Saturday, July 19**

8:30 AM **Curbside Conferences**

Display booth sponsors:
American Association of Colleges of Pharmacy
American College of Apothecaries
American College of Clinical Pharmacy
American Council on Pharmaceutical Education
American Institute of the History of Pharmacy
American Pharmaceutical Association
American Society of Hospital Pharmacists
American Society for Pharmacy Law
Bureau of Health Manpower
Drug Enforcement Administration
Food and Drug Administration
National Association of Retail Druggists

Pharmaceutical Manufacturers Association
The Proprietary Association

10:00 AM **Education for Industrial Practice**
Moderator: John J. Sciarra, Ph.D.

"Education for the Pharmaceutical Industry"
Robert V. Smith, Ph.D.

"Education for the Pharmaceutical Industry — Some Alternatives"
Keith Marshall, Ph.D.

"Educating for the Pharmaceutical Industry"
J.N. Banerjee, Ph.D.

12:00 **Lunch**

2:00 - 4:00 PM **Education for Institutional Practice**
Moderator: William C. Lubawy, Ph.D.

"Education for Institutional Practice"
Clifford E. Hynniman, M.S.

"Educating Pharmacists for Institutional Practice in Developing Countries"
Marilyn F. Harris, Ph.D.

"Preparing First Degree Pharmacists for Institutional Practice"
Gerald E. Schumacher, Pharm.D., Ph.D.

4:00 - 6:00 PM **Contributed Paper Sessions**

A. Presiding: Mitchell L. Borke, Ph.D.

Presenters:
C.N. Aguwa and A. Kar
K. Boakye-Yiadom
Chung-Hsiung Chen and Weng F. Huang
Yehia M. Dessouky and Saadeddin El Migirab
Mohamed A. Eldawy
N.I. Yao Fiagbe
A. Ghazal
Sayed H. Hilal
J.S. Qadry
R. Wasicky

B. Presiding: Charles F. Peterson, Ph.D.

Presenters:
E.H. Froese
P.G. Hugbo
M. Khalifa
Werner Lowenthal
V.O. Marquis
Keith Marshall

J.E. Murad and T. Myrtes Murad
Bona Obiorah
Harkishan Singh and Vijay K. Kapoor
H.P. Tipnis

C. Presiding: Sumner Robinson, Ph.D.

Presenters:
A.A. Ageel, A.A. Al-Badr and A.C. Ellison
Ee-Kiang Gan and Musa Bin Mohamad
E.O. Ogunlana
E. Ramstad and B.J. Wilson
Arthur C. Sackeyfio
William Simonson and Clara Collette-Pratt
Roxie R. Smith
R.S. Summers
Geoffrey N. Vaughan

**Sunday, July 20**

8:00 AM **Breakfast**

Report by U.S. Food and Drug Commissioner Jere Goyan, Ph.D.

9:00 - 11:00 AM **Forces Affecting Pharmacy Education**
Moderator: Benjamin Hershenson, Ph.D.

"Forces Affecting Pharmacy Education"
Harold H. Wolf, Ph.D.

"Government's Impact on Pharmacy"
Nathan Watzman, Ph.D.

"Forces Affecting Pharmacy Education — An Industry Perspective"
William H. Helfand, B.S.

11:00 AM - 1:00 PM **Pharmaceuticals for Developing Countries**
Moderator: Lawrence C. Weaver, Ph.D.

"Pharmacy and the Third World"
Patrick F. D'Arcy, D.Sc.

"Overview on Pharmaceuticals for Developing Countries"
Leighton E. Cluff, M.D.

**Conferral of the George Urdang Medal upon Rudolf Schmitz**
by the American Institute of the History of Pharmacy
Presenter: Robert G. Mrtek, Ph.D.

1:00 PM **Adjournment**

# EDUCATING FOR THE PHARMACEUTICAL INDUSTRY

By **J. N. Banerjee, Ph.D.**, Managing Director, Sandoz, India, Ltd., Bombay, India

## THE HISTORIC PERSPECTIVE

Western medicine was brought to India by the Portugese after the conquest of Goa in the 16th century. The first hospital in India was established in Goa in 1510. The precursors to the British Crown, the East India Company, consolidated Western medicine in India, establishing a hospital in Madras in 1679 for its English soldiers.

Until that time, India's two major medical systems were the Ayurveda, rooted in Atharvaveda—the last of the four Vedas, a compendium of Hindu intellectual thought, and the Unani, introduced by the Muslim invaders in the 12th century.

## PHARMACY EDUCATION

Western pharmacy education and practice were also brought into India by the Portugese, who started, around 1900, what were known in Portugese as Lyceum courses, including anatomy and mathematics. The course ranked with the high school graduation certificate, and the medium of instruction was Portugese.

Holders of this certificate worked as helpers in the pharmacies in Goa owned and conducted by the Portugese. Some migrated to the nearby commercial cities of Poona and Bombay in the British Empire and worked as helpers in pharmacies run by British pharmacists—firms such as Kemps, Thompson and Taylor, Treacher, and Bliss. The work was, of course, exclusively compounding. After apprenticing with Portugese and British pharmacists, many of these men set up their own pharmacies.

## INDUSTRIAL PHARMACY

India's first encounter with industrial pharmacy followed the identification in Europe of medicinal properties in the cinchona bark in the latter part of the 19th century. To feed industrial production of quinine in Europe, cinchona plantations were set up in Bengal and Madras. Factories then were established for the extraction and purification of quinine.

## THE PHARMACEUTICAL INDUSTRY IN INDIA

Educating for the pharmaceutical industry in India has a direct relationship to the character and dimensions of the industry, current and potential. I will, therefore, first sketch these dimensions. Following this, I will explain the pattern of pharmaceutical education that is emerging in India and the areas that need to be strengthened and make a projection for the future in terms of the industry's potential for growth.

Since my subject is Educating for the Pharmaceutical Industry, I will exclude from my purview the areas of hospital pharmacy, retail pharmacy, clinical pharmacy, patient surveillance, drug consultancy, and others not directly related to pharmaceutical research, production, analysis or quality control, and distribution.

Until India's independence in 1947, the country depended for drugs chiefly on imports from the United Kingdom and the European countries, although a few entrepreneurs had set up units for the manufacture of simple drugs, vaccines and sera.

Organized production and distribution of pharmaceuticals on the dimensions of a cohesive, modern industry commenced only in 1956, based on the recommendations of the government's Pharmaceutical Inquiry Committee, set up in 1953.

The government's Industrial Policy Resolution that followed in 1956 also kept the doors open to technologically advanced countries abroad to establish research and manufacturing units in India. Therefore, research-based firms, notably from the U.K., the United States, West Germany, and Switzerland, brought in their technologies and the fruits of their research, the new generation of drugs—sulphonamides, antibiotics, corticosteroids, vitamins, hormones, and a host of other synthetics, phytochemicals and biologicals. Along with their technology, they introduced a drug industry culture of quality consciousness, a scientific attitude, a systems approach to every area of operation, and professional management.

The industry in India today comprises four sectors: the government or public sector; the large-scale Indian sector; the small scale sector; and the foreign collaboration sector.

The growth of the industry in the areas of basic manufacture, formulation manufacture, investment, and research and development are as follows.

## Bulk Drug Production

Bulk drug production in 1978-79 was Rs. 2000 million ($229 million). Fourteen years ago, in 1965, it was Rs. 180 million ($20.6 million).

Here, I must explain a very significant factor. When Ehrlich established the principle of chemotherapy in 1905, Germany already had a well-established basic chemicals industry which included fine chemicals; in fact, it was this industry that inspired and supported Ehrlich's pioneering work. The head start that European countries had in the development of a sophisticated drug industry is also attributable to the existence in those countries of a highly developed chemical industry.

In India, however, because the chemical industry had not developed, pharmaceutical firms had largely to import their needs of fine chemicals and intermediates for basic manufacture. Now, however, the government's organic chemicals unit and the petro-chemical units now are supplying some of these requirements.

## Investment

Investment in 1977-78 was Rs. 4500 million ($517 million). In 1967, it was Rs. 1500 million ($172 million).

## Research and Development

Expenditures on research and development rose from Rs. 58.60 million

($7 million) in 1972 to Rs. 80 million ($9 million) in 1975-76. Thirty-four firms engage in research and development, and four or five units are engaged in basic research.

## Exports

Exports are an index to quality standards. Exports of bulk drugs and formulations rose from Rs. 234.20 million ($27 million) in 1975-76 to Rs. 291.20 million ($33 million) from 1979 until February 1980.

Among the developing countries, India ranks second in terms of value of drug production, next to Brazil. UNIDO has placed India in Group V, its classification of countries that manufacture most of the intermediates they require and also undertake research and development. However, India, which contributes 15 percent of the world's population, at present accounts for only 2 percent of the world's drug production.

From the profile I have just outlined, it will be seen that in every major component the pharmaceutical industry in India compares favorably with its counterparts in the advanced countries and is poised to become their peer in the coming decade.

I now will relate the range and scale of pharmaceutical education presently available to feed the manpower needs of an industry of this dimension. I then will give a projection of the education plans to match the growing needs of the industry.

## PHARMACEUTICAL EDUCATION

### History

Pharmaceutical education in India preceded the founding of the organized pharmaceutical industry by almost a quarter of a century. In 1931, Banaras University started a degree course in pharmaceutical chemistry; a few years later, this course was converted to a B.Pharm. course. Its graduates found employment in the nascent pharmaceutical industry, which started evolving in the early 1940s, the drug control administrations, and the new teaching institutions that began to spring up in the 1950s.

The first legislation to regulate pharmaceutical education was passed only in 1948, under which the Pharmacy Council of India was set up. As an organized pharmaceutical industry had not yet taken shape at that point in time, the Pharmacy Council concerned itself with a syllabus for dispensing pharmacists. It decided that a two-year diploma course in pharmacy was adequate for dispensing pharmacists and left it to the universities to start degree and post-graduate courses in pharmacy.

Therefore, when scores of pharmaceutical manfuacturing units started to arise from 1956 onward, there were not enough pharmacy graduates around. These units, therefore, took in science graduates and chemical engineers, and thus pharmacy lost an opportunity to establish a tradition of preserving the pharmaceutical sector as its specialty area for exclusive or primary employment.

The tradition of qualification preferences established then, and largely followed until today, is as follows:

| | |
|---|---|
| Basic manufacture | M.Chem<br>B.Chem.<br>M.Tech. and B.Tech. |
| Formulation manufacture | B.Sc. (chemistry) upward<br>B.Pharm. upward |
| Quality control | B.Sc. (chemistry) upward<br>B.Pharm. upward |
| Research and development (formulation development; pilot production) | M.Pharm.; Ph.D. |
| Basic research (toxicology; pharmacology) | M.Pharm.; Ph.D. |

The trend of the industry being an open field for chemistry graduates now is being gradually halted. The first step has been taken by the Drug Controller of the Government of India, which has proposed an amendment to its manufacturing rules by which only pharmacy graduates should be employed in formulation manufacture. Formulation production in India is more labor-intensive than any other operation, and therefore pharmacy graduates will find good scope for employment here. The amendment is being opposed by the small-scale sector, which would have to pay higher salaries for pharmacists with the bachelor's degree.

Pharmacy graduates are reluctant to enter the quality control area, however, as the production areas offer them greater career opportunities. Nearly 80 percent of those employed in the quality control area are science graduates.

## Current Status

Today there are 25 institutions offering the B.Pharm. degree, with a total annual turnout of about 800 graduates; 17 offer a master's program, the annual turnout being around 150; and 8 receive Ph.D.s in pharmaceutical sciences each year. These courses are offered by the departments of science of universities, colleges affiliated with universities, and polytechnics.

The University Grants Commission (UGC) lays down the framework of a syllabus for the universities to follow. The result has been that there is today no standard syllabus or standard duration for the graduate course. At some institutions, the courses are three years in length after higher secondary; at some, four years after higher secondary; and at some, four years after junior college (10 + 2).

The All-India Council of Technical Education (AICT), a government body, is responsible for laying down norms for qualification of teachers, staffing pattern, workload, and minimum hours per subject. This council now plans to standardize both syllabi and duration. It recently decided to offer financial assistance to universities to start post-graduation courses in pharmaceutical sciences.

One three-year degree course is offered by the Bombay College of Pharmacy, conducted by the Maharashtra Branch of the Indian Pharmaceutical Association and affiliated with Bombay University.

For the master's program, the disciplines offered for specialization are pharmaceutics, pharmaceutical chemistry, pharmacognosy, and pharmacology. With few exceptions in most of the institutions, the two-year course is partly fulfilled through research and partly with papers.

In terms of the needs of the pharmaceutical industry, the areas of course content that need to be strengthened are bioavailability and drug interaction.

## Interaction Between Faculty and Industry

The AICT encourages teachers to spend their vacations working in industry. This provides an honorarium in addition to the salary the teacher's institution would pay. The industry has been fairly receptive to this scheme.

The UGC, for its part, encourages industry personnel to take lecture courses at teaching institutions on specialized topics. The volunteer is reimbursed for travelling expenses and also is paid a nominal honorarium. The industry has been receptive to this scheme, as well, but the problem has been the difficulty of sparing executives for such missions.

The UGC also gives financial assistance to universities to organize summer schools when industry personnel can conduct special courses. In the past ten years, only three such courses have been organized by the universities.

## Interaction Between Industry and Students

This interaction is a part of the curriculum. Graduate students must spend a total of at least eight weeks in a manufacturing unit. The industry, in turn, is compelled to offer these facilities at no cost to the student.

A scheme of apprenticeship has been in existence for the past two years. Graduates must apprentice themselves in any activity of their choice at a manufacturing firm for one year. The government gives the graduate a stipend; the firm must match this stipend or, of course, may exceed it.

## Registration

There is no provision for registration for graduates intending to take up manufacturing or quality control jobs in the pharmaceutical industry; however, after three years of such employment, their service must be approved by the FDA. Approval is required for each type of activity—tablet formulations, ampoule formulations, syrup formulations, etcetera. A minimum of three years must be spent in each activity before approval can be granted. This applies to all science graduates in these activities.

## The Industry and Education

Has the pharmaceutical industry in India taken any initiative in actively promoting pharmaceutical education? Earlier, I referred to the Bombay College of Pharmacy. This college owes its existence entirely to the industry, and it is a fine example of the industry getting together to promote pharmaceutical education.

The majority of the pharmaceutical manufacturing firms are located in Bombay city, producing 60 percent of the all-India output. These firms helped the Maharashtra Branch of IPA to set up an educational institute that started by offering diploma courses and now has grown into a college offering graduate, post-graduate, and Ph.D. courses. From the very purchase of the land to the construction of the buildings, equipment for the laboratories, etcetera, the funds have come from the industry. The majority of the members of the governing body of the college are from the industry.

## WHAT OF THE FUTURE?

At present, the pharmaceutical industry can cater to only 20 percent of a population of 650 million. This gives an idea of the industry's potential for growth and of the potential for educating for a pharmaceutical industry of this dimension.

In the short-term—by 1982-83, the VI Plan aims to:

- raise capital investment from the current level of Rs. 4500 million ($517 million) to Rs. 7500 million ($860 million);
- nearly double formulations production from the current annual level of about Rs. 10500 million ($1207 million) to Rs. 19,000 million ($2176 million);
- more than double bulk drugs production from the current annual level of about Rs. 2000 million ($229 million) to Rs. 4750 million ($544 million); and
- step up exports and research and development expenditures substantially.

This will increase the per capita consumption from the present $1.5 to about $3. Compare this with the current per capita consumption in other Asian countries—China, $3; Malaysia, $4.27; the Philippines, $4.25—and you have an idea of the vastness of the potential for the growth of the industry and the tasks for educating for an industry of such proportion.

In this titanic canvas, in which areas must we concentrate? In Great Britain, according to the 1972 Manpower Survey, 66 percent of pharmacy graduates are engaged in general and retail practice, with only 5.1 percent in pharmaceutical production. A similar pattern would exist in all countries where only graduates must do retail practice. For India, no such figures are available, but it is important to point out that there is no statutory requirement that only pharmacy graduates should engage in retail practice. Rather, this is done by diploma holders or by persons given registration certificates on the basis of experience.

Where India is concerned, therefore, that removes a sizable chunk from the pharmaceutical sector for pharmacy graduates. Education for them, therefore, necessarily must concentrate on the needs of the industry in the areas of basic and formulation production, quality control, basic research, and research and development, and on the constant technological changes that are taking place in these areas. Newer areas may open up, as they have in the United States—documentation, registration, clinical trials—as regulations for new and old drugs increase and multiply.

What, then, are the plans for expanding educational facilities to match the growing needs of the industry in these areas? Way back in 1953, the Pharmaceutical Inquiry Committee, which had proposed a blueprint for the organized development of the pharmaceutical industry, also foresaw the importance of building up an educational infrastructure that would provide qualified manpower for the pharmaceutical industry and recommended the setting up of a Central Institute of Pharmaceutical Sciences.

The government has accepted that recommendation but until today has pleaded lack of funds to establish the institute, although the Pharmacy Council of India has been pursuing the matter vigorously. It therefore necessarily follows that the industry must remain the prime mover and the sustaining factor in defining and promoting education for the pharmaceutical industry.

With the Bombay College of Pharmacy as its nucleus, the industry is trying to establish an Academy of Pharmaceutical Sciences. The model of curriculum and other activities envisaged is:

1) Medicinal Chemistry
    a. Synthesis of drugs on pilot plant and semi-pilot plant scale
    b. Drug design
    c. Development of new curricula

2) Pharmaceutics
    a. Solid dose forms
    b. Drug delivery systems
    c. Bio-pharmaceutics and pharmacokinetics
    d. Sterile product technology
    e. Packaging technology

3) Pharmacology
    a. Physiological pharmacology
    b. Bio-chemical pharmacology
    c. Bio-assay of drugs

4) Phytochemistry and Pharmacognosy
    a. Active drug principles in plants and their extraction
    b. Cultivation of medicinal plants
    c. Tissue culture of medicinal plants

5) Quality Control
    a. Development of new methods of instrumental analysis
    b. Automation in analytical procedures
    c. Record keeping and retrieval
    d. Computerization
    e. Legal procedures and regulations

In addition, there would be:

a) a service wing for the industry where nominees of industry can be trained in the different aspects of production—basic and formulations; quality control; packaging; good laboratory practices; good manufacturing practices; clinical trial protocols and procedures; drug control; and legal procedures; and

b) facilities for joint research, contract research, pilot batch testing, drug testing, and any other assistance required by individaul manufacturing units on a contract or joint basis.

While the first five academic areas will prepare the manpower needed by industry in specific disciplines, the service wing will help to reduce investment and training costs of individual units, especially the medium and small-scale manufacturers.

There will be provisions for senior pharmaceutical staff to be seconded to the faculty of the academy for specified periods and for the regular faculty to work in the industry on similar lines. The objective will be to provide a common environment for both industry and pharmaceutical education, for the greater good of both.

# OVERVIEW ON PHARMACEUTICALS FOR DEVELOPING COUNTRIES

By **Leighton E. Cluff, M.D.,** Executive Vice President,
The Robert Wood Johnson Foundation, Princeton,
New Jersey, U.S.A.

Disease has interfered often with the master plans of strategists who wish to improve the economic, social, and political development of a nation. Many historical examples show that disease has had devastating effects upon the populations of particular regions, upon achievement of commercial, economic or political objectives, and upon personal and social well being.

Today, infectious, parasitic, and other diseases in developing countries adversely affect social, economic, and political development. If these diseases are controlled, the consequences certainly could be dramatic. The health and standard of living, particularly of the poor people, in these countries could be advanced impressively.

Poverty contributes to the occurrence and prevalence of many diseases, including those attributable to infection; however, some of these diseases can be controlled despite coexistent economic deprivation. For example, smallpox now largely has been eliminated from the world, including the poor and developing countries. The ravages of poliomyelitis have been eased, and death rates from infantile diarrhea and cholera have been lowered significantly in both poor and affluent segments of several countries without concomitant changes in socio-economic conditions.

These and other diseases were controlled by widespread application of specific, effective medical interventions. Other specific and effective interventions exist and could be used to control some important diseases which are particularly prevalent in developing countries. In these instances, we must find ways to remove obstacles to and provide incentives for their use. In other instances, we must encourage and support the research needed to understand the diseases and the development of appropriate interventions.

Some specific interventions that effectively control diseases can be administered to large populations. Such interventions may not require continuous access to personal health services such as those provided by physicians or other health professionals. A vaccine, for example, can be administered to all children in a community or population to control a particular disease, even though there is no one regularly available to care for individual children when they are sick. In other circumstances, effective interventions can be made available only to individuals who have been evaluated by a personal health professional who can prescribe a particular treatment; then, the entire population has to have access to personal health services if the intervention is to affect significantly the public health.

Many developing countries lack effective systems and sufficient numbers of trained providers to deliver personal health services to the population at large. In addition, the public health systems in many of these countries are ill prepared to meet the needs of the total population. Therefore, even available interventions that could be used effectively to control specific diseases cannot be deployed easily. These countries will need assistance to enlarge and strengthen their personal health care services and their public health systems in order to distribute and use effectively interventions that are now available or that could be developed.

The occurrence and prevalence of particular diseases vary among the developed countries. Nevertheless, some diseases affect poor and deprived people wherever they live. For example, infantile diarrhea and respiratory diseases occur commonly among poor children in every country. Other diseases, such as schistosomiasis and cholera, are largely confined to particular geographic areas of the world. Most diseases that occur primarily in developing countries affect the poor and rural populations. As many people move from rural areas to the cities, such diseases may become less prevalent, but the expanding urban populations suffer from diseases common to areas of poverty anywhere.

Most technology is difficult to apply under conditions of extreme poverty unless directed against specific problems. It is impossible to control all diseases, and it makes much more sense to direct efforts at the control of one or a few diseases at a time. Appropriate employment of available and effective interventions and the continuing search for weak links in the epidemiological and pathogenetic chains of specific diseases are important aspects of practical and successful efforts at disease control. Smallpox was controlled by a specific focus on it—not through efforts aimed at disease control in general. Although personal hygiene and environmental control measures would reduce significantly the burden imposed by many infectious and parasitic diseases on the people in the developing countries, also of vital importance are the widespread application and use of specific drugs and vaccines that can control effectively the incidence, severity, and outcome of particular diseases.

Production and supply of several vaccines and drugs that would effectively control specific diseases are insufficient to meet global requirements. Without planning and investment, and without a better data base on which to gauge the need, it will not be possible to meet projected rises in demand for those pharmaceutical agents. Systems must be developed for distribution and administration of agents to control a disease, and the required resources must be provided. Specific vaccines and drugs are needed in the developing countries, and perhaps such needs should be better reflected in their domestic budgetary priorities; however, the cost of obtaining these pharmaceuticals cannot be met by those countries without help—international cooperation and assistance will be necessary.

Never before in history have the opportunities for rational scientific and technologic approaches to health problems of developing countries been so great as they are now. The research, development, and production capacities of the pharmaceutical industry in the United States have achieved a commanding position in practical and theoretical efforts to perfect available drugs and vaccines and to generate new agents for use in developing countries. Nonetheless, current constraints and regulation of the pharmaceutical industry in the United States function as disincentives to capitalizing upon such opportunities and accepting the challenge to develop new and improved drugs and vaccines which may find their greatest—and perhaps even their sole—applicability beyond the borders of the United States.

Furthermore, the amount of encouragement and support of research by academic scientists in the disease problems of primary concern to developing countries has been less than that necessary to exploit emerging scientific opportunities and challenges. Academic scientists provide most of the fundamental information needed for the practical development of new or improved medical interventions. The pharmaceutical industry, on the other hand, has organized the multidisciplinary approaches required for development and production of these agents. Natural linkages exist between the efforts of academic scientists and the interests of the pharmaceutical industry. These linkages must be strengthened to optimize the efforts of both communities.

Neither academic scientists nor the pharmaceutical industry can confine their activities to the United States in conducting all of the studies needed to investigate diseases which occur only in developing countries. If the expertise in the United States is to be directed toward the study and practical development of agents to control diseases principally occurring in developing countries, arrangements must be made for some of these efforts to be conducted in those developing countries. Political, financial, and scientific cooperation between developing countries and the United States is essential if academic scientists and the pharmaceutical industry are to contribute effectively toward control of disease in the developing world. At present, legal, regulatory, fiscal, political, and social constraints compromise implementation of such efforts. They must be modified or removed before much can be accomplished.

Improving international health requires better partnership arrangements between government, industry, academic, public, and private institutions—supported by popular understanding and encouragement. Anything less will compromise optimal contributions to the health needs of the poor and sick in the many developing countries. Furthermore, failure to implement intensive efforts to control diseases prevalent in developing countries will impair significantly any and all other efforts toward facilitation of socio-economic advancement in impoverished and heavily populated countries.

NOTE: Based upon a paper published in the Conference Proceedings on Pharmaceuticals in Developing Countries, IOM/NAS, Washington, D.C., (IOM-79-001), 1979.

# PHARMACY AND THE THIRD WORLD

By **Patrick F. D'Arcy, D.Sc.,** Head, Department of
Pharmacy, The Queen's University of Belfast, Belfast,
Northern Ireland

At the FIP Congress in Brighton in September 1979, a special session was devoted to "Pharmacy in the Third World", in which some of the pharmaceutical problems of developing countries were highlighted and emphasized. This session proved to be a catalyst for further action. Since then, FIP has contacted pharmacists and pharmaceutical bodies in developing countries, asking for a brief report setting out what are seen to be the main pharmaceutical problems. National pharmaceutical associations, which have ordinary membership in FIP, have been invited, as a matter of urgency, to form Third World committees to liaise directly with FIP.

It well may be that pharmaceutical problems do not seem to be relevant in a priority scale which is dominated by starvation, inflation, escalating unemployment, refugee problems, growing world population, advancing desert, and pollution of air and water; however, in the Third World, pharmaceutical problems are part of the general health problem and so may be lifted out of context to be given higher priority—for without health, there can be no steady progress toward solving the other economic problems.

Several of the reports received in reply to the FIP appeal for information on Third World pharmaceutical problems have described schemes, already in progress, which are aimed specifically at dealing with some of the health and pharmaceutical problems. For example, grants for health purposes have been given by some commercial banks, including: The World Bank; The Inter-American Development Bank; The Asian Development Bank and Fund; and The African Development Fund.

Representatives of the World Health Organization (WHO) and the international pharmaceutical industry currently are visiting ten of the least developed countries to assess their pharmaceutical needs. WHO has issued a list of 230-250 "essential drugs" to help developing countries to avoid ordering unsuitable and wasteful drugs. Unfortunately, this list is somewhat controversial, and it is the view of many that the list could be reduced to a mere 20-30 "essential-essential" basic drugs. A number of pharmaceutical companies in Germany and in other European countries have expressed to WHO their willingness to cooperate by supplying drugs at special prices to the least developed countries. Trainees from developing countries are given instruction in industrial and quality control laboratories in Germany and in the WHO laboratories. In Sweden, the Collaborating Centre for Chemical Reference Substances supplies standard substances to Third World countries to facilitate their own quality control procedures for imported and locally manufactured medicines. Universities in the United Kingdom, Europe and the United States enroll an increasing number of students from Third World countries and train them for basic or higher pharmaceutical qualifications.

It is common in industrialized, developed countries to question whether the developing countries are doing enough to help themselves to solve their own problems. Pharmaceutical problems are no exception to this. General questions are not satisfied by anything except specific answers, and it is clear from the information gained by the FIP Third World Project that many countries are striving against almost impossible odds to provide a measure of health care for the less fortunate members of their community.

## LOCAL DRUG MANUFACTURE versus IMPORTATION FROM OVERSEAS COMPANIES

In many Third World countries, there is considerable mistrust of overseas pharmaceutical companies. The quality of the drugs imported often is questioned, as are the prices charged. Local subsidiary branches of international companies often are treated with suspicion; it is commonly claimed, for example, that they often manufacture for local use drugs which have been withdrawn from use in more developed countries. More frequently, the local population have little confidence in drugs that are manufactured locally, even though they have been shown to be of good quality.

Financial constraints often dictate that the cheapest drugs available on the international market be bought via government tenders. All too often, such supplies have been shown to be sub-standard, and, in countries which have inadequate quality control facilities, these deficiencies are not always revealed.

The price of drugs causes universal concern. It frequently is held, with some justification, that drugs manufactured locally by subsidiaries of international companies are sold at relatively higher prices than are charged for the corresponding products in more developed countries. International companies, on the other hand, are not enthusiastic about investing capital funds in countries which are politically unstable. The pharmaceutical industry is, to a great extent, "capital intensive," whereas often in a developing country the requirement is for a "labor intensive" industry to provide employment for the populace. The two requirements are therefore often poles apart: the capital intensive industry needs high investment for plant and equipment, while the government of the country expects the industry to recruit and employ local personnel at staffing levels far in excess of that required for this type of industry.

Lack of adequately trained or qualified local personnel is an added complication, since the import of expatriate staff to run the industry is a considerable financial burden which must be reflected in the elevated cost of the final drug product.

Although drugs, especially essential drugs, can be manufactured well by local industry, the high cost of importing manufacturing plant and raw materials also is reflected in the relatively high cost of the local product. Delays in the delivery of materials and spare parts for the machines also contribute to higher costs because of delayed or extended manufacturing schedules.

## INADEQUATE DISTRIBUTION AND STORAGE FACILITIES

Transport facilities in most Third World countries are limited; they are also subject to adverse climatic conditions. Rural areas are often devoid of any reliable transport system, and distribution of drugs is, therefore, poor. If health is to be a priority, then what is needed in most developing countries is to ensure that treatment and medication are available to the sick patient at the time of need.

Communications in the widest sense and drug distribution in particular are key problems in such countries. For example, during a recent visit to the Sudan, I visited a small group of lepers living within a village near Sorba on the outskirts of Khartoum. The lepers, somewhat surprisingly, were being looked after and fed by the villagers. Dapsone, the main treatment for leprosy, was not available, since the major distribution point in that region for the drug was in Omdurman, some 15 miles away. Because no transport was available, and since the patients were suffering from lepromatous leprosy and were crippled and could not walk, they did not get the drug they so urgently needed to halt the progress of their disease.

A problem closely allied to distribution is that of storage facilities. Generally, these are poor to inadequate in Third World countries. In those countries where the main urban areas are distant from the port of entry of goods, or where the country is land-locked, long delays in the delivery of drugs or raw materials for local manufacture are common. Customs delays due to licensing or import regulations are frequently excessive due to bureaucratic inefficiency, lack of trained staff, complicated legislation, or the simple lack of understanding that medicines cannot be treated as ordinary articles of commerce. In tropical countries, such delays and the resultant storage of drugs in ports, docks or airport areas can be disastrous to the ultimate quality and potency of the drugs. Lack of refrigeration facilities is contributory to the problem, although the basic problem is that drugs are not given the priority of clearance that they obviously require. Frequently, complaints of poor quality made against the overseas supplier are shown subsequently to be due to poor storage or transit facilities after the drugs have been delivered to the Third World country. In my experience, complaints about low potency of insulin supplies subsequently were traced to storage of the injections in a tin-roof shed at an ambient temperature of well over 100 degrees Fahrenheit.

## STRICTER DRUG LEGISLATION

Drug legislation in many Third World countries is either inadequate or not enforced. Laws well may exist to control the sale of such drugs as antibiotics, hypnotics, tranquilizers, and antidepressants, but such laws are frequently disregarded. Government inspection to ensure compliance with the law is minimal or absent, and the pharmacist abdicates professional responsibility in favor of commercial gain.

The high standards by which many companies operate where there are effective drug regulatory authorities, as in European and North American countries, are not followed in less privileged areas of the world.Examples of this double standard are that no warnings about blood dyscrasias are mentioned by the manufacturer of chloramphenicol nor by the manufacturers of phenylbutazone when these drugs are marketed in South America, although such warnings are obligatory in the USA. Similarly, in no South American market did chlorpromazine carry any warning to doctors that it could cause jaundice, extra-pyramidal side effects, dystonic reactions, or tardive dyskinesia.

It has been suggested to FIP that adjoining Third World countries could draw up profitable joint and common drug legislation based on the needs and requirements of their local conditions and not on those laws which seem to work well in more developed countries.

## DRUG RESEARCH FOR "UNPOPULAR" DISEASES

If adequate communication and effective distribution of medicines are amongst the key priorities in developing health care, then clearly the provision of adequate and specific drug treatments for indigenous diseases or the adaptation of existing drugs for greater utility in the tropics also must be given priority. In many instances, it is not a shortage of effective drugs that is the problem; rather, it is the fact that the way in which the drugs have to be administered is just not suitable for use in a developing country. To cite one example, kala-azar requires a series of up to 30 intramuscular injections of pentavalent antimony and there is no alternative. The expense of giving the 30 injections and ensuring that the patient complies with the schedule is out of all proportion to the basic cost of the drug.

Some years ago, there was some correspondence in the pharmaceutical and medical literature about drug research for unpopular diseases. The gist of the arguments presented was that funds and facilities should be made available for work on drug treatments that could never hope to be commercially viable. Anyone who has worked in the tropics will be aware that many of the indigenous diseases fall into this category, notably: malaria; leprosy; tuberculosis; schistosomiasis; leishmaniasis; trachoma; and helminth infestation. It was then also advanced, as an added complication, that even if improved treatments were available, it was doubtful whether in some developing countries the people or their governments could afford to support a more costly drug bill. It was then, as it is now, usually a case of doing the most good with the funds available, and the "Third World diseases" in such instances do not get their deserved share of attention.

The problem is international, and, obviously, multinational effort could have a greater potential for success than any isolated national program of research, however well-intentioned. The "unpopular diseases" do not have national barriers, and, if their treatment is to be improved, it would be logical to expect that research, development, and clinical trials should of necessity be shared between those countries that have the financial or technical resources to help and those that have an adequate incidence of the particular disease to make field trials possible.

If the concept of multinational collaboration is feasible, then the obvious question is: Who is to do the basic research? Is it to be done in the universities? In the laboratories of the pharmaceutical industry? Or is it to be done in the non-commercial research institutes? The choice, of course, does not necesarily lie between one or the other; all three sectors have a potential and complementary role. The organization for basic research exists to a highly developed degree within the pharmaceutical industry; the industry is already international, and there are several companies that are truly multinational with research and production facilities in many countries. The usual complications of governmental participation in commercial programs of research and development, such as patent protection, exclusive marketing, and price agreements, do not arise, since this type of drug research is, by concept, non-profit making. Realistic contract terms or tax concessions for work done would seem to be a possible basis for such involvement.

The universities and the non-commercial research institutes could contribute greatly and successfully, as they have done in the past, to the basic research or to the development and further elucidation of the activity and safety of such medicines.

Primarily, the accurate definition of objectives and the establishment of mechanisms for collaboration and funding are needed. Could it not be within the province of WHO, in its objectives of "Health for All by the Year 2000", to obtain additional funds from governments and then to award contracts or give grants to centers of excellence for work on well-specified targets? Could not, perhaps, a proportion of the international aid given to developing countries be re-channeled to this objective?

Drug research is costly, and costs increase dramatically as targets become more difficult, but disease is also costly, not only in terms of human suffering and misery but also in limiting the economic potential of the community. Such monies would, therefore, reap a greater reward if they were invested in the health of the people in developing areas, since, by overcoming the inertia of indigenous disease, they would enable the people themselves to be better able to cope with their own economic problems.

## SHORTAGE OF TRAINED PERSONNEL

Availability of suitable drugs and adequate medical care at the time of need are the main problems to be solved if the disease burden of the developing countries is to be reduced by any significant degree. Many such countries invest much money and resources, time and dedication in training doctors, nurses, pharmacists, and other health professionals, but so often, after relatively short periods of governmental or community service, these professionals leave to embrace the more lucrative private practice in their own or in more developed countries.

It is interesting, however, to note from FIP reports that distribution of drugs under the control of private pharmacies is much more efficient than the distribution of drugs to the hospital or government dispensary, even in the townships. This could be due to financial causes, but, at least in part, it is also due to a shortage of trained personnel in the government medical sector. Of the pharmacists who qualify locally or overseas, very few enter government service; thus, very few actually become available to deal with the basic pharmaceutical problems of their countries.

It is apparent that many more pharmacists are needed than can be provided by the present system if a constructive attack is to be made on the problems which are described in the reports received by FIP.

Some developing countries have created their own schools of pharmacy, but for those many countries which cannot afford to do this, it may be that the foundation of a central school of pharmacy in a suitable location would solve many pharmaceutical manpower problems. This central school, operated on an international basis, could be financed by international health organizations or multinational sources. It would be oriented specifically toward the pharmaceutical needs of the Third World and by teaching and research in the Third World would do much to overcome its own specific and essential problems.

We would like, through the medium of this conference, to invite assistance with the FIP Third World Project from all interested pharmaceutical organizations, especially from those pharmacists who work or have worked in developing countries. Perhaps you would be kind enough to write to me (Professor P.F. D'Arcy), giving any information that YOU think to be important.

Professor P.F. D'Arcy
Department of Pharmacy
The Queen's University of Belfast
Medical Biology Centre
97 Lisburn Road
Belfast BT9 7BL
Northern Ireland
United Kingdom

# THE UNITED STATES PHARMACEUTICAL INDUSTRY

By **Lewis A. Engman**, President, Pharmaceutical Manufacturers Association, Washington, D.C., U.S.A.

I am indebted to the American Association of Colleges of Pharmacy for inviting me to participate in this Congress. One of the great challenges, I think, of our age, as it gets more and more complicated, is that all of us have a need to strive to communicate better with each other. It is important to increase meaningful communication among the various groups interested in health care: the government, pharmacists, the medical community, manufacturers, consumers. It is also important that we increase our communications among and with those in other countries who are interested in these same problems. I have found in my experiences, wearing a number of different hats, that in many, many instances we in the United States can profit greatly by the experiences of other nations. I think that the fact that there is such a broad participation from other nations in this Congress is a tribute to its planners.

My charge today is to describe the present state of the pharmaceutical industry and to hazard a few predictions about its future. Not too long ago, we were hearing predictions that medical progress had reached a plateau. It was argued that scientific advances were like mineral deposits. From time to time, we stumbled on a rich seam and a new burst of discovery occurred, but in time the seam became mined out. The flow of riches dwindled. Scientific knowledge languished in a near static state until someone stumbled upon a new deposit.

Today, anyone who reads the newspaper is likely to get the opposite impression. Far from being on a plateau, we appear to be on a new seam and on the upswing of a cycle. Today, you can scarcely pick up a newspaper or a magazine without seeing an article about the new generation of therapeutic miracles, the wonder drugs, just over the horizon. We are told that modern medical researchers may have struck the richest seam of therapeutic potential since antibiotics, if not of all times—and let us hope so. But if it is true—and there is strong evidence to suggest that it is, it would be unfortunate if we allowed this happy set of events to divert attention from the fact that whatever new medicines eventually emerge will have done so against rising odds.

In science, just as in mining, it helps to know where to look. It also helps to be lucky. But in the long run, in this day and age, what really determines the rate of discovery is the level of resources committed to the task. The Comstock Lode may have been discovered with a pick, and Colonel Drake may have hit oil in Titusville, Pennsylvania with a 67-foot hole, but such events are rare, and they are getting rarer, as the current prices of oil and silver attest. There is no more easy oil. There is no more easy silver. And there are no more easy medicines. All the fruit has been picked off the bottom branches of the tree.

Discoveries today come at great cost, each of them a star in a galaxy of dry holes. As Mark Novitch mentioned earlier this morning, that medical researchers should be producing the secrets of interferon through recombinant DNA or the secrets of the endorphins is vastly to their credit. But, I suggest, it is also in some sense a fortuitous and ironic aberration, because the truth is that these breakthroughs come in the face of a trend toward not rising, but shrinking, commitments of resources to research. One can only applaud what has been accomplished, but no one who understands what is happening to commitments to medical science can help but feel concerned that the euphoria of success will divert attention from the fact that future successes are being rendered less and less likely by exogenous economic forces. The fact is, pharmaceutical research in the United States is slowing down. In constant dollars, the pharmaceutical industry research and development expenditures have declined as a share of sales by almost one-half since 1962, and discoveries of new medicines by American firms also have declined.

That is only part of the story. Looking at what has occurred at the other end of the medicine development pipeline—that is, at the point of market introduction, today the United States, while still first in discoveries of new medicines, ranks only ninth in new introductions. Why? What is going on? What is the reason for this seemingly bizarre state of affairs? I'll have to say at the outset that there is, of course, no single culprit. Certainly there is no person, no institution that has willfully produced this situation. I do believe that there is, nonetheless, a fairly compact explanation.

I submit to you this morning that the slowdown in the flow of new medical innovations is largely the result of a peculiar and wholely unintended interaction between the drug approval process and the patent law, an interaction which, over the last 18 years, has brought about a transformation in the industry's investment equation. Briefly, the situation is this: When a pharmaceutical company discovers a promising new medicine, it must file for a patent promptly in order to protect itself. The patent's term—17 years—starts to run when the patent issues, which is nearly always before FDA has approved the new medicine for sale, and thus, some portion of patent life is lost. That is to say, some portion has expired before the innovating firm has had a chance to earn back any of its investment. Now, until 1962 that portion was never large enough to be a problem; but in 1962 Congress passed amendments to the law that required FDA to certify a medicine as being effective as well as safe before allowing it on the market. That is a law which I think that we can all applaud, but what was not then foreseen was how long it ultimately would take for these determinations to be made. This was no minor oversight. Today, it takes, on the average, between seven and ten years from the time of discovery of a new medicine to get it approved for marketing. For most of that time, the patent clock is running. The result is that effective patent lives for pharmaceutical products have been cut nearly in half.

Before elaborating further on this problem, I think it might be worth taking a moment to examine the purpose of a patent. Patents have been around since the fifteenth century. Our founding fathers decreed in our Constitution that Congress be empowered to promote the useful arts by securing to inventors the exclusive rights to their discoveries. It was not solicitude for the well-being of inventors that fathered patents. On the contrary. It was the perception that the patent provided the individual an inducement to spend money and energy in furtherance of the public welfare. It was the realization that as advances in technology rendered serendipitous discovery increasingly obsolete as a strategy for progress, some means of stimulating new discoveries was required. The patent was the answer. By assuring that the inventor's successes would pay for themselves, it provided the individual the incentive to invest in innovation. By tendering no favors for failures, it promoted efficiency. And by spurring the march of progress, it furthered the public interest.

It is no accident that enactment of patent laws in nearly every European nation accompanied the explosion of industrial technology that characterized the first one-half of the nineteenth century. But today in the United States, we have a situation born of inadvertance which turns this logic on its head. At a time of steeply rising medical costs, we are discouraging the innovation which history and recent experience tell us is our best hope for a more effective and less expensive therapy. The pharmaceutical company in 1980 faces each research investment decision with the knowledge that its opportunity to recover its investment may be only half as long as the statutory grant. For almost all other industries, the time remaining on a product's patent when it is marketed is much closer to that 17 years. One doesn't have to be an economist to see the dampening influence this has on the industry's inclination to accept risk.

The cost today of developing a new medicine is about $70 million. In contrast, the cost of producing most medicines, once discovered and tested, is relatively low. Obviously, no firm can afford to commit itself to such large research costs if competitors are free to copy the resultant product before those costs can be recovered. And as patents' lives shrink, we see what the economists call the "free rider effect", which is to say that the innovator takes the risk, while the competition gets a free ride. The end result is predictable: no company can for long afford to give the competition a free ride; in time, it too stops taking risks or reduces the risks which it does take. That is to say, it reduces its research investments.

With the cessation of risk comes a slowdown in innovation, especially in the instant case, because in the pharmaceutical research business, where 1,000:1 shots are the rule, risk taking is the name of the game. When one points this out, the frequent response is, "Well, you're making plenty of money. What's your complaint? If we give you back the rest of your patent life, you'll just make more." That's possible. But if the industry does make more, it will be because it has responded by doing what the patent was intended to promote.

People must understand that the pharmaceutical industry is actually not one, but at least two industries—a research industry and a pill industry. Every pharmaceutical company is in the pill industry. Fewer and fewer today are in the research industry. Declining patent lives have made research less appealing. Discovery costs have risen. Recovery time has declined. Companies have, therefore, been dropping out. Decisions to invest in research are like decisions to invest in anything else. Companies calculate the cost, the return, the risk. They compare it with the alternatives, and they make their choice.

It will help, I think, put the matter in perspective by thinking of each company's investment decision as similar to that of a person comparing newly offered bonds. Each bond issue has its own yield. That yield determines its price, and hence the volume of funds flowing into the underwriter's coffers. If the yield is low relative to other issues, the price will fall until the yield becomes competitive.

If the yield is high relative to the alternatives, the price will rise until the issue is no longer a bargain. In either case, the market quickly adjusts all prices and yields to the point at which, abstracting from differences of risk, one investment is pretty much like another. And so it is, too, with the investment alternatives which corporations face. If anticipated yields from research are low, the flow of funds into research will decline until, by eliminating that long shot, lower yield possibilities, parity with alternatives is established. If research returns rise, resources commitments will rise until declining marginal returns reduce yields to the point where further commitments are not attractive. The point of all of this is that restoring patent life would simply mean money presently being diverted to other uses would be re-channeled back into research.

A second objection I have heard holds that patent restoration would add to corporate profits without any public benefit. That argument ignores the very logic of patents. The point of any patent is to create a financial incentive to produce a socially desirable result. In this case, the incentive is profit, but the result is more therapies and, thus, more competition. To assume that there is no public benefit in this is to assume that for every symptom there is only one therapy and that whoever finds it first can exploit at will. This is just not the case. The whole point of encouraging investment is that there will always be more and better therapies if someone is given the incentive to look for them. Even where the result may be the development of alternative medicines for the same disease, the consumer benefits. The consumer benefits because competition has been increased.

There is no end of the road in scientific terms—no point past which there is no utility in exploration. But there is—or can be—an end to the road in economic terms, namely, a risk reward calculus which says whatever lies out there in the great scientific unknown is past reach because no one can recover the costs of its discovery. That limit may be a real one, but it is a limit which we impose on ourselves.

Finally, one hears the question, "Why can't a company with an effective patent life of only eight or nine years simply price its new medicines high enough to recover its investment over the shorter term?" The answer is, it can't always be done. A major breakthrough in medicine may command a large price premium, but most therapeutic advances come in small increments. These small increments may add up to a major advance rather quickly, and they provide price competition to keep the market honest, but they cannot command large premiums.

Setting aside the question of equity, the truncated patent lives currently accorded pharmaceuticals are ill-advised in public policy terms. National expenditures for medicine are, and have been for many years, a declining fraction of total health care expenditures—today in the United States, less than 7¢ on the health care dollar, despite the fact that medicine therapies have steadily surplanted other, far more costly, methods of treatment, such as surgery and hospitalization. If there is anywhere a case to be made for cost effectiveness of health-relative investment, it is in the development of medicines. Medicines, not doctors, not hospitals, are the reason people don't go to sanitariums, that kids don't die of smallpox, that the populations of mental hospitals have shriveled across our land.

The pharmaceutical companies are not the real victims of the present policy. It is the American people who are the real victims, for being deprived of new therapies, for being deprived of the benefits of price competition from multiple therapies, and for paying the greater cost of existing forms of health care, such as surgery, lengthier hospital stays, and prolonged home care.

It is a sad irony that with a major health care cost problem to solve in this country, we put the golden goose on half rations. By administrative accident, we have warped investment decisions, we have strayed from the path of cost effectiveness, and we have produced in the process a waste of potential that we can ill afford. Already we are paying for this folly. We will go on paying until something is done to correct it.

Over the industry's future there also hangs the spectre of a new kind of regulation, a regulation not of product quality or of safety which is the kind of regulation which I think that industry has come to accept as being a necessary part of the health care system. The new regulation is a regulation of markets and of profits. Like shortened patent lives, this new regulation will have a major impact on the investment calculus. I suggest to you that it also will have a major impact on the future of pharmacy in the United States.

What, then, can I say about the future of the pharmaceutical industry? The record suggests that the pharmaceutical companies will do well. What the record cannot tell us is **what** they will do well. Will it be making pills? making cosmetics? deodorants? bug sprays? Or will it be doing medical research? These are sophisticated, well-managed companies; they do what sophisticated, well-managed companies do. That is to say, they constantly re-allocate their resources. They get out of activities where declining returns threaten survival. They get into activities where returns are more attractive. There are dozens of pharmaceutical companies that are doing alright by every conventional measure, but they have been giving up research because they cannot afford the losses. Many would happily do research again if they could make it a paying proposition, and I don't doubt that some still engaged in research are teetering on the brink of decision of doing likewise. It will be a great shame if this trend is allowed to continue, and it will be a loss to our country.

It is not the corporation whose future is in jeopardy. The corporation is not going to drink the hemlock because government prices it out of the neighborhood. Corporations are adaptable. They will find a new home doing something else where the odds of survival are better. But in the process of doing so, they will leave behind more vacancies, more boarded-up houses in the community of scientific inquiry. If that happens, we will all be a little poorer for it.

Thank you very much.

# UNITED STATES PHARMACY EDUCATION

By **Melvin R. Gibson, Ph.D.**, President, American Association of Colleges of Pharmacy, and Professor of Pharmacognosy, Washington State University, Pullman, Washington, U.S.A.

It is an honor and a pleasure to be here this morning. The title "United States Pharmacy Education", assigned to me by the Planning Committee, is so general that I could include just about anything in my remarks. The members of the committee know me well enough to recognize that, whatever the title, I would say anything I wanted to say anyway. Therefore, I shall pick and choose areas of United States pharmacy education about which to talk. I certainly cannot be all-inclusive in the time allotted; I shall limit my remarks to undergraduate education. My remarks are my own, and they may or may not reflect the views of the American Association of Colleges of Pharmacy.

The principal goals I have set for myself this morning are to be informative about pharmacy education in this country and to present my views on that status. At no time should my remarks be construed as projecting U.S. pharmacy education as a model for any other country. I shall tell you how it is, how it got to be that way, and some of the problems we have. I look forward to learning similar aspects of pharmacy education in countries other than our own; these next few days should provide a forum for all of us to learn from each other.

## THE BEGINNINGS OF PHARMACY EDUCATION

To understand U.S. pharmacy education, I think it is necessary to review some of the history of U.S. higher education with particular reference being given to pharmaceutical education.

The first university in the New World was not an Anglo-Saxon discovery. Higher education in the Western Hemisphere was first suggested in 1538 by authorization by Papal bull of the University of Santo Domingo. Beginning with the actual opening of the Royal and Pontifical University of Mexico in 1553, higher educational institutions made their appearance in that century and in the early part of the following century in Peru, Guatemala, Colombia, and Argentina.

One reason for the delay in establishing higher education in the English colonies was the uncooperative attitude of the American Indians, who, with the massacre of 1622, aborted the Henrico College in Virginia. Undaunted, the English came back in 1624 with a plan for an Academia Virginiensis et Oxoniensis—loosely translated as "Oxford in Virginia", but this never came into being. Oxford and Cambridge were the models for the inauguration of higher learning in America, with the founding of Harvard College in 1636.(1)

In comparison with that in many of the countries represented at this Congress, formal pharmacy education in this country is very young. In the latter part of the 18th century and in the 19th century, much reliance was placed on apprentice training of pharmacists. In the early—mid-17th century—colonization of this country, not only were there no colleges of pharmacy, there was a great shortage of pharmacists. Probably the first shop known in British North America was that of William Davis (or Davice), right here in Boston. An official town record of 1646 refers to an order for the erection of a fence "for the benefit of the Apothecary Davice". In the Dutch colony, Surgeon Gysbert Van Imbroch ran a shop in New Amsterdam in 1653 that well may have been a drugstore, but the "general store" he operated in Wildwyck (Kingston) from 1663 to 1665 was certainly one of the early drugstores of North America.

Few trained practitioners of pharmacy were found in the early colonial period. Medicine and pharmacy were not separated; the physician practiced pharmacy, and the apothecary practiced medicine.(2)

The apothecary in early America trained apprentices. A Virginia statute in 1736 distinguished between the qualified physician and the apothecary who had "served an apprenticeship to the trade". This distinction was made for fee purposes: for the same services, the apothecary could charge only half as much as the physician.(3)

Apprenticeship was the root of pharmaceutical education in this country, as it was for medicine and law. As the 18th century saw the separation of medicine and pharmacy, it also saw the proliferation of pharmacies, often shops carrying a lot of things not pharmaceutical—in those days, this was necessary for a livelihood. The small number of people served made multi-merchandise establishments the common thing; hence, the general store became the forerunner of the department store and the multi-purpose drugstore the forerunner of the supermarket drugstore of today. The need for more pharmacists in this country was underlined by their services to the Revolutionary War.

Apprenticeship as a sole means of entering the profession was to continue into the 19th century and, as a possible means of gaining entry, even into the 20th century. Pharmacists recognized in the early part of the 19th century that they could not continue to bear the burden of educating future pharmacists, but they were reluctant to give up the chance to play a major role in their education. They would apprentice the young people in the daytime and then charge them fees for night school—the pharmacists paid the apprentices menial wages in the daytime and took it away from them at night!

Associations of pharmacists became interested in education as one of their objectives. Among the several objectives of an association in 1821 called the Philadelphia College of Pharmacy was formal instruction in pharmacy by means of lectures. This eventually became the paramount objective of the organization and resulted in the development of the Philadelphia College of Pharmacy as a teaching institution.

Between 1821 and the Civil War, additional local societies termed "colleges of pharmacy" were established in Boston, New York, Baltimore, Cincinnati, Chicago, and St. Louis;(4) these eventually evolved into the Massachusetts College of Pharmacy, Columbia University College of Pharmacy, University of Maryland College of Pharmacy, University of Cincinnati College of Pharmacy, University of Illinois College of Pharmacy, and St. Louis College of Pharmacy. Only three of these association-sponsored colleges remain as separate, private colleges of pharmacy: Philadelphia College of Pharmacy and Science, Massachusetts College of Pharmacy, and St. Louis College of Pharmacy. Other association-sponsored colleges were taken over by the states for fiscal reasons. The University of Michigan established the first school of pharmacy in a state-supported institution in 1876; now, all but six states have one or more state-supported colleges or schools of pharmacy.

American education, whether it be pharmaceutical or general university, always has been experimental. It has been and continues to be decentralized. There is no central government office offering advice, although there are those offering statistics. In spite of this absence of central control, one does not find as much diversity as might be expected. The states exercise little control over the private or endowed universities; they are supervised by boards of trustees that are self-perpetuating and have no obligations to federal or state governments except to stay within the law. State-supported universities and colleges are without regulation by the federal government except so far as the use of federal money is concerned. The states, in general, leave the governance of their universities to appointed boards. Interference by the states in the business of the academic considerations of a state university is usually met with strong academic opposition; where it is not, the university may suffer until it gets a strong administration—sometimes these days, that doesn't take too long, since the average university president lasts for about four to six years.

America grew quickly. In its haste to discharge its enormous responsibilities, it attempted to adopt programs and practices from other countries, often changing them beyond recognition because the conditions of American life and the aims of American education were different from those found anywhere else.(5)

This freedom remains today. It is an unusual year that does not see the announcement by some university of a "new" plan for university education. Sometimes, this uniqueness is only observable in the publicity agent's rhetoric, but the American spirit of adventure is still there. Some 26 years ago, the president of Columbia University said:(6)

> I think that far too many of our institutions contribute unconsciously to popular confusion by trying much too zealously to be all things to all men. They are too prone to yield to external pressures, too willing to accept offers of funds which have embarrassing strings attached to them, too eager to have a bewildering profusion of course offerings which make their catalogues resemble in varieties the offerings of a mail-order house. An impressive array of courses is no substitute for intellectual leadership, but the saving factor in the situation is that there is virtually no known curricular device by which an earnest and intelligent young man can be prevented from getting some kind of an education.

This statement is no less true today, and it applies to all elements of higher education.

The outgrowth of early colleges of pharmacy from apprenticeship is typical of early college education in this country: special interests built special interest-oriented institutions. By 1900, there were special colleges for Baptists, for

Catholics, for men, for women, for whites, for blacks, for rich, for not-so-rich, for North, for South, for engineers and for teachers, as well as for pharmacists. Many of the colleges were dreams of their special interest groups—sometimes unrealistic dreams. Most, if they have survived, have had to sacrifice their differences to appeal to the masses. As I have indicated, only three of the separate private colleges of pharmacy have survived, and even they often have had to enlarge their offerings to more than pharmacy exclusively. The private colleges of pharmacy affiliated with private universities survive; the state-supported institutions predominate.

The early for-profit establishment of colleges of pharmacy was not unique to pharmacy. During the 19 th century, 457 medical schools were opened in the United States and Canada.(7) Administration of schools of medicine obviously was not so demanding in those days. The dean of the Harvard School of Medicine published his academic office hours as between 12:15 p.m. and 1 p.m. on Tuesdays and Fridays "to conduct school business".

It took the Flexner Report in 1915 to bring medical education up short and set it on the track of scientific medicine. Pharmacy had no such jolt, but it did have a far-sighted educator in Dean Albert B. Prescott of the University of Michigan, who, in the late 19 th century, insisted on a thorough instruction in basic sciences—especially chemistry—as preparation for pharmacy study. Another factor contributing to the advancement of pharmaceutical education was the establishment in 1900 of the American Conference of Pharmaceutical Faculties, which in 1925 was renamed the American Association of Colleges of Pharmacy. Since its inception, this organization has been a potent factor in improving the status of pharmaceutical education.

The Association early in its development introduced minimal standards for collegiate membership:

> The only means employed by the AACP for enforcing its minimal standards has been withholding the privilege of membership in the Association. As the Association became stronger over the years, the privilege and the prestige of membership has come to be highly prized in the American colleges of pharmacy.(8)

The Association began early to prescribe minimal standards for course length for member colleges. In 1904, 40 weeks were required; in 1907, 50 weeks in two years; in 1925, 3 years; in 1932, 4 years; and in 1960, 5 years.

Departure from the apprentice-based curriculum brought American pharmaceutical education out of the vocational era and into the professional era. The chemical base as instituted by Prescott and the biological base as fostered by Rufus A. Lyman set pharmacy on the road to respectability as a health science.

The eminent educator Clark Kerr has said:(9)

> The addition of science has had the greatest single intellectual impact within higher education since the modern college began replacing the classical college a century ago. The first professor of sciences was appointed at Yale in 1800, but the great growth of science came after 1870. At first,

> agriculture was the greatest single center for scientific endeavors; later, it was national defense; now it is the health sciences. The biological sciences got their great impetus from agriculture; defense gave great emphasis to the physical sciences; and now the health sciences are giving great impetus to both the biological and the physical sciences. The health sciences are now more at the center of the further spread of science within higher education than is any other major field of endeavor. Thus they are one of the major coalescing centers for intellectual activity in modern America. They draw together more strands of scientific endeavor than does any other single segment of higher education. They are a particularly dynamic focal point for the discovery of new knowledge. Only the study of ecology now seems likely to compete for this central role.

The future of pharmacy depends upon its scientific bases in the physical and biological sciences, with an infusion of the social sciences. Without this solid foundation, it cannot exert its unique functions in either the practice of pharmacy in the retail or clinical arenas.

## THE BASIC PHARMACEUTICAL SCIENCES AND THEIR APPLICATION IN THE PRACTICE OF PHARMACY

In the historical overview just presented, I referred to the practical experience forerunner of modern-day pharmaceutical education. I also concluded that what did most to bring pharmacy into its present professional state was the inclusion of the basic sciences (pure and pharmaceutical) in the curriculum.

The prominent educator James Bryant Conant said:(10)

> . . .the essential element in the advance of modern science has been the curious interplay between. . .theoretical notions and the experimentation of the artisan; through such an interplay scientists have built up a fabric of interconnected concepts and conceptual schemes.

The interplay of the basic sciences and the practice of pharmacy has been a slow and lopsided process in the United States. From no basic sciences, we went to all basic sciences in our teaching. The students of my generation received a heavy load of sciences and only a slight bow in the direction of practice—the minimum required by the state boards of pharmacy, and that not supervised by any institution. Experience of whatever nature was accepted by the state boards. We were propelled into the practice of pharmacy with a lot of theoretical knowledge but with very little concept of how to use it. It is no wonder there developed the criticism by practitioners (which still exists today) that too much theoretical and too little practical education was being required in pharmaceutical education. How the information was to be used very often remained in the minds of the educators, if it existed at all.

Early attempts to introduce supervised practical experience in the field into collegiate responsibilities met with only limited success; only a few schools attempted to assume this responsibility. Not until the concept of clinical pharmacy arrived on the scene did pharmacy schools begin to take an active interest in the responsibility of providing not only the scientific background for pharmacy practice but also the "interconnected concepts" to which Conant referred.

There are various definitions of clinical pharmacy; however, I like the one Varro Tyler proposed in 1968:(11)

> . . .that division of pharmacy which deals with patient care with particular emphasis on drug therapy. In practice it is patient oriented and includes not only the dispensing of required medication but also advising the patient on the proper use of all medications both prescribed and patient selected. It also utilizes the pharmacist as an information source for members of the medical and other health professions on all matters pertaining to drugs and their dosage forms.

Sources differ as to who would be credited with getting clinical pharmacy off the ground as a pharmacy area in the sense that we have come to recognize it today. Donald C. Brodie, the current Honorary President of the American Association of Colleges of Pharmacy, in 1965 (12) described the concept in a manner most appropriate to its current state. His institution at the time, the University of California at San Francisco, instituted the so-called "Ninth Floor Project" in 1966, which put into practice a broad-spectrum clinical pharmacy program for a limited number of students.

In 1967, the University of Michigan sponsored the Pharmacy-Medicine-Nursing Conference on Health Education. The need for a clinical component in the curriculum was underlined at this conference. Since that time, faculties have begun to incorporate into their curricula courses in clinical pharmacy and practice settings for the implementation of the didactic concepts. The sources of clinical faculty personnel essentially have been Pharm.D. programs; hence, pharmacy's "clinical staffs" are, to a large extent, persons with practical experience in clinical settings but without graduate training.

The integration of clinical pharmacy into the curriculum has not been easy. Schools have accomplished it in various ways: by decreasing the number of outside electives; by decreasing the number of inside electives; by eliminating basic science courses (both general and pharmaceutical); by combining courses; by lengthening the time required to complete the requirements. Integration without expanding the time for the curriculum has meant sacrificing subject matter, and all too often this has been at the expense of the basic pharmaceutical sciences, which are the bulwark of pharmaceutical education. All too often, instruction in clinical pharmacy has included too much of what a physician should know and not enough of the clinical aspects of what a pharmacist should know and what a physician does not know. We are still in the growing-pain stage of clinical pharmacy, and, like growing pains, it hurts in places.

There is a tendency in some quarters to over-emphasize the curriculum in favor of the clinical area. When this involves an excessive amount of school-supervised experience in the hospital, clinical, and retail settings, we see the pendulum swinging again toward practical experience as a method of teaching. We are swinging back toward the days when all of pharmaceutical education was practical experience—apprenticeship. I see nothing wrong with that, as long as sufficient time is allotted to it without jeopardizing the basic pharmaceutical sciences' role in curriculum and as long as the experience is well organized and well supervised.

## MILESTONES IN PHARMACEUTICAL EDUCATION

The milestones in pharmaceutical education in the United States are sometimes distinct and free-standing; others are more subtle and less easily defined. Obviously, the earliest milestone is the setting up of schools to teach pharmacy; I covered this in the first portion of my remarks. The steady increase in school entry requirements also constitutes well-defined milestones, as do the increases in the length of the curriculum. These milestones address the increased responsibility of pharmacists.

As far as curriculum is concerned,three studies are of primary importance. Publication in 1910 of The Pharmaceutical Syllabus was the first attempt to formalize a recommended curriculum. It grew in scope over about 30 years and finally died from overweight—of volume, not influence! The volume Basic Material for a Pharmaceutical Curriculum (13) appeared in 1927 and became more familiarly known as the "Charter's Report". It was informative and extensive, but it dealt with the curriculum as it was and had little in it of an imaginative nature for the future. To do that was left to The Pharmaceutical Survey, which was born through an AACP resolution in 1943 and resulted in the most comprehensive study of pharmaceutical education ever made. It resulted in two of the most important free-standing documents thus far developed: The General Report of the Pharmaceutical Survey (14) and The Pharmaceutical Curriculum (15). Had the recommendations of The Pharmaceutical Survey been followed, pharmaceutical education and the profession would be much more advanced than they are today. The Pharmaceutical Curriculum served as an authority for decades following its printing. Parts of it are quoted even today, although it was published 28 years ago.

The founding of The American Journal of Pharmaceutical Education in 1937 through the efforts of its first editor, Rufus A. Lyman, was of utmost importance to pharmaceutical education. It always has been the only journal of pharmaceutical education in the world. Its contents have recorded the progress, the hopes, and the dreams of pharmaceutical education since 1937, and it remains one of the greatest contributions of its sponsor, the American Association of Colleges of Pharmacy.

The formation of the American Conference of Pharmaceutical Faculties in 1900 was another significant milestone in U.S. pharmaceutical education. As the progenitor of the American Association of Colleges of Pharmacy, this organization has affected profoundly the standards of pharmaceutical education in this country through membership requirements previously described and through its current actions and reports. The establishment of the American Council on Pharmaceutical Education in 1932 was the second most important organizational milestone for pharmaceutical education. With the formation of the Council, formal examination of schools of pharmacy became a requirement—not only for the school's membership in AACP but also for its graduates to be eligible to take state board examinations if they wished to reciprocate between states.

The third most significant organizational milestone to affect pharmaceutical education was the founding in 1942 of the American Foundation for Pharmaceutical Education as a product of action of the National Drug Trade Conference. The Foundation from 1943 to 1979 has given away approximately $8 ½ million in the interest of pharmaceutical education; currently, its funds are used primarily to support graduate fellowships and the American Council on Pharmaceutical

Education. In past years, it has supported a variety of needs of pharmaceutical education; most of those projects no longer receive support because of a shortage of funds available to the Foundation. Its founders' goal of a dynamic foundation with sufficient resources to provide income from endowments to enable funding in perpetuity has not been realized. The Foundation has been supported primarily by the pharmaceutical manufacturing industry; however, industry's support has been commensurate neither with its capabilities nor its responsibilities.

## EFFECTIVENESS OF PHARMACEUTICAL EDUCATION AS RELATED TO CURRENT DEMANDS OF THE PROFESSION

### Fiscal Resources

In the relationship of the schools and the profession, pharmacy is not much different from other professions. Justice Oliver Wendel Holmes was talking about law, but could have been talking about pharmacy just as well, when he said:(16)

> Indeed the exalted image of a profession provided by its better schools may first help it attract better recruits than it deserves and then help sustain these men in the face of its often sordid and tedious reality.

More recently, the late Dr. E.R. Weinerman wrote about medicine:(17)

> The method and quality of medical education define the potential competence of the physician, but it is the system of medical care organization within which he actually works that determines the degree to which this potential is translated into effective performance.

The pharmaceutical profession enjoys a reputation among those it serves which often surprises the profession as a whole. Pharmacists, particularly in small communities or suburbs, have the respect and confidence of their patrons. The baffling element is often the profession's low opinion of itself. I am always chagrined when a student comes to me and reports that his local pharmacist has asked him why the hell he is studying pharmacy. I remember the same thing happening to me. The self-image of many pharmacists is low. Often, they blame pharmaceutical education for not teaching them what they think they need most (usually, more business courses) and for teaching them things they do not need.

Pharmaceutical education always has taught students more than they need to know for the level of pharmacy practice usually observed at that point in time. Progress in professional services depends on continuing that policy; the practice of pharmacy in the United States has progressed as far as it has because of the foresight and idealism of pharmaceutical education. Through this century, educators have refused to listen to the dire predictions of many in the profession and have plunged fearlessly into the future with hopes high. It has made mistakes and will continue to make them, but no one can say education did not act in what it thought were the best interests of the profession.

The phrase "overtrained and underutilized" has been applied to the practicing pharmacist: overtrained for what often is found in practice but underutilized due to not taking advantage of opportunities to use the training that has been received. Too many take the easy way out by just counting, pouring, licking, sticking, and merchandising rather than exploring their potential as health professionals who have much to offer their patrons and other health professionals.

Not only has pharmaceutical education not received the support of the profession to which it is entitled, it also has not received the support of the universities of which the colleges are a part. Just as we see great conservatism in the professional ranks of pharmacists, we see great conservatism in the administration of our colleges of pharmacy. In large part, the colleges of pharmacy are not treated on the same level with other professional schools, such as medicine, dentistry, law, or even veterinary medicine. Much of the blame for this rests with pharmacy deans who have not fought hard enought to obtain adequate staffs, adequate salaries, and adequate facilities. I am not necessarily referring to current deans, although it does apply to some. Some current deans have had to fight for what they have gotten against their predecessors' tradition of conservatism; as most of you know, once a pattern has been set within a university system, it is often very hard to break. The cause has not been helped by what the general population too often sees going on in the corner drugstore or, more to the point, the supermarket drugstore—too much commercialism and too little professionalism.

The future is promising. Colleges of pharmacy are developing better methods of teaching their students for the real world, and through continuing education they are taking a more active role in postgraduate education. Pharmacy associations are better and more vocal but are still inadequately supported by the profession. Future relations between educators and practitioners are promising, but the road ahead is far from easy. No matter what the criticism from the profession, the colleges must maintain their prerogatives of vision and idealism. We must not make the mistake of the Russians. The Russians have abandoned the aim of versatility and have turned to narrowly trained specialists, the reason being that Russian educators never have been able to protect the educational system from the demands of the labor market. Americans must always remain able to distinguish between education and training.

## FUNDAMENTAL PROBLEMS FACING PHARMACEUTICAL EDUCATION

I have made reference this morning to a number of problems confronting pharmaceutical education. I list some of these below with some I have not had the opportunity to address: 1) lack of adequate support from the profession; 2) insufficient funding from parent universities; 3) restrictions of the five-year curriculum; 4) supervision of internships, externships, and clerkships; 5) women's future role in pharmacy; and 6) competition for the students' time and mind between the basic science and clinical faculties.

As regards the latter conflict, the following is a quotation from Aristotle:(18)

> As things are there is disagreement about the subjects. For mankind are by no means agreed about the things to be taught, whether we look to virtue or the best life. Neither is it clear whether education is more concerned with intellectual or with moral virtue. The existing practice is perplexing; no one knows on what principle we should proceed—should the useful in life, or should virtue, or should the higher knowledge, be the aim of our training; all three opinions have been entertained.

I have previously made reference to the problem of integrating the clinical pharmacy component into the curriculum. This will continue to be a problem until colleges are willing either to accept two classes of pharmaceutical training (the baccalaureate and the Pharm.D.) or to accept the Pharm.D. degree as the only entry degree for the profession.

It would be inappropriate of me to end my remarks about United States pharmacy education without giving some vital statistics to provide a clearer picture of the two-degree problem and the impact clinical pharmacy is having on our schools. They also will underline the problem of the future role of women in pharmacy.

There are 71 accredited schools of pharmacy in the continental United States and another in Puerto Rico. Of these, three are separate, free-standing schools. Fourteen are affiliated with private universities, and 54 are in state-supported or state-related institutions. In 1978-79, 6,922 baccalaureate degrees were awarded; this was 248 fewer than the previous year. In 1978-79, 651 Pharm.D. degrees were awarded; this was 99 more than the previous year.(19) An AACP survey this last year revealed that 16 AACP member colleges have moved or are planning to move to the Pharm.D. degree as the first professional degree. In 1978, when our House of Delegates voted to retain the two-entry level degree system, only three colleges were committed to all-Pharm.D. education; since that time, one other school has joined these three as an all-Pharm.D. granting school. Summarizing the November survey: 43 colleges offer no Pharm.D. programs, 12 offer the program only on a post-bachelor's basis, and 17 offer the degree as both an entry and postgraduate program. Since that survey was made, other changes have occurred; however, the November survey indicates the general pattern of the two degrees offered. The American Council on Pharmaceutical Education recently clarified the process for persons from other countries to obtain the Pharm.D. degree as a postgraduate degree.

Enrollment figures for the fall of 1979 indicate that more than one-quarter of the schools (eighteen) now report female enrollments of 50 percent or more. The national figure now stands at 42.7 percent, an increase of nearly 2 percent over last year.(20) If one compares this with the 1963-64 data, the increase is quite dramatic; in that year, only 13 percent of the students were female.

> The impact of the increased proportion and number of female practitioners will be felt in all areas of pharmacy, especially in hospital pharmacy. While women pharmacists, like male pharmacists, were most numerous in community pharmacies, they comprise over 28 percent of hospital pharmacists. The attraction of women to the institutional setting is easily understood because it offers a professional atmosphere and regularly scheduled working hours, providing for basic adaptation to the dual roles of career and family.
>
> One of the concerns surrounding the employment of professional women is how to retain large numbers of them for more extended portions of their adult lives; that is, to increase their work-life in professional activity. A study of the career longevity of female pharmacists has revealed that their mean professional life is only about 16 years, primarily because of marriage and family-related responsibilities.
>
> Existing career patterns for professional women also indicate they frequently work less than men, in terms of hours and weeks of work per year in professional practice. Although data on women in pharmacy are sparse,

evidence indicates that the professional career of the average female pharmacist is shorter than that of the average male pharmacist. For this reason, there is a substantial interest in the growing number of women in pharmacy.(21)

Pharmaceutical education in the United States faces many challenges; I have had time to give the background of only a few. Pharmacy has come a long way, and it has yet a long way to go to provide to mankind the services of which it is capable. The way will not be easy. The way never has been easy.

I should like to close with a quotation from Oliver Wendel Holmes:

> As life is action and passion it is required of man that he should share the passion and the action of the time, at the peril of being judged not to have lived.

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# UNITED STATES PHARMACY PRACTICE

By **Raymond A. Gosselin, Sc.D.**, President, Massachusetts College of Pharmacy and Allied Health Sciences, Boston, Massachusetts, U.S.A.

Pharmacy practice in the United States has been strongly influenced for the better part of its history by the compelling need for a method of orderly and systematic distribution of prescription and nonprescription drugs as the country experienced population growth, mobility, and expansion. Pharmacy can be rightly proud of the excellent system that it has developed over the years for the distribution of drug products. Virtually no community in the country is without ready access to whatever drug may be needed by whatever patient at whatever time.

Accessibility has become a highly visible and appreciated attribute of the profession. Retail pharmacies developed as a product of the private enterprise system, which, in responding to the needs and desires of a diverse and heterogeneous society, created a highly pluralistic retail drug distribution system. The economic support of the profession has been, and still is, deeply rooted in the add-on values associated with drug product transfer.

The distribution function reached its working efficiency some time ago, and the profession has since found itself responding to other pressures and forces which inevitably have created change in the manner in which services are provided and in the role of the individual pharmacist.

During the early post-World War II period, a rapid development in technology saw the virtual end of the pharmacist's role as a manufacturer of extemporaneous compounds at the bench; the need for product standardization, quality control, and mass production and distribution shifted this activity to the industrial environment.

This transition was quite orderly as the demand for prefabricated prescription drugs expanded at a phenomenal rate over the course of 25 years. A rapidly increasing population, a sharply increasing scale of living coupled with a growing economy, and a vastly improved educational level all combined to produce an astronomical demand for health care services in general and prescription drugs in particular as the latter became the principal means of treatment for the ambulatory ill.

Pharmacy practice, particularly in the ambulatory or retail sector, experienced enormous growth. Prescription activity in the average pharmacy rose from approximately 10 percent of a typical pharmacy's business in 1950 to almost 60 percent in 1975. The number of prescriptions dispensed in all retail establishments doubled every decade, reaching approximately 1.5 billion in 1975.

While many pharmacists deplored the loss of the compounding function and the abrupt change in practice style, most were quite satisfied to accept the increased volume in dispensing activity as a manifestation of their contribution to the community's health care. The typical pharmacy during this era became less dependent on nonprescription activity as a means of economic viability.

Further change, however, would intervene as pharmacy's success inevitably would attract new forms of activity and create new forms of competition. The large corporate chain, long a major factor in general retailing and always a part of pharmacy, began to increase its market penetration, not only of total volume but of prescription activity as well.

As pharmacy responded to these far-reaching changes, the society it served continued to change at an increasing rate and in a multifaceted way. Alvin Toffler's "future shock" had arrived for pharmacy. By the mid-1960s, consumerism had emerged as a powerful factor in the United States—something new for the country. Prior to that time, the American economic system in most regards—and particularly in the health care field—had operated under the rule of caveat emptor, meaning "let the buyer beware". The emergence of consumerism and the organized consumer movement in America quickly changed this to caveat venditor, or "let the seller beware". We suddenly were a "buyer's market".

With the preoccupation of dispensing a rapidly increasing volume of prescriptions, many pharmacists tended to lose sight of the fact that personal contact with patrons, so long a characteristic of the profession, was being lost in the face of mass consumption and mass distribution techniques. The resulting impersonality made pharmacy highly vulnerable to the forces of a burgeoning consumer movement which, seeing the impersonality as a norm, now differentiated between individual pharmacies on the basis of prescription prices.

At about this same time, another major development occurred which would impact profoundly upon the direction pharmacy would take. The country became aware that while a large proportion of the population was quite capable of acquiring for itself its needed prescription drugs and pharmacy services, a smaller but significant portion was not so blessed. While some private third party insurance programs providing drug benefits had been in existence since the turn of the century, they had been quite minor and generally insignificant in the total picture.

Society by the late 1960s had accepted the concept of providing, at the federal level, tax-supported drug benefit programs for the poor. For the first time in its history, the United States passed important federal legislation to provide prescription drugs to the medically indigent and to the hospitalized elderly, where drug use and consumption exceed the general population average by a factor of two to three.

These programs, administered either by the federal government or jointly by the federal government and the various state agencies, from the very outset began to impose constraints on the manner in which pharmacy was to be practiced, principally because of the government control over reimbursement levels for drug costs and pharmacy services. The percentage markup system for prescription drugs, easily borrowed from the traditional general merchandise carried in drug stores, was replaced by a constant dollar markup labeled the dispensing fee. This dispensing fee was not the same as an individually calculated "professional fee" designed to cover professional service as well as all other costs associated with prescription dispensing.

Pharmacy's input into the design of these programs was woefully weak, divided, and often badly misguided; the very diversity in types and kinds of establishments providing pharmacy services to the nation prevented the marshalling of an effective voice for pharmacy in these developments. Among the serious mistakes was the error of accepting as a professional fee the government-set and - fixed dispensing fee.

Government drug programs have approached pharmacy reimbursement and drug cost problems as if the 50,000 pharmacies in the nation were some giant monolith capable of responding uniformly and universally to rigid control methods. The reality of pharmacy's pluralism has made this impossible, and the problems created by this major incompatibility rage to this day.

Two additional factors need to be mentioned before we attempt to characterize pharmacy in America in 1980 and speculate on the future. These are the forces of pharmacy education and governmental cost containment practices.

Pharmacy education and government planners generally concurred during the 1970s that the then prevailing demographic factors and trends would create a demand for prescription drugs and pharmacy services in the future so enormous and complex that steps needed to be taken to provide adequate manpower for the demands of this century and well into the next.

The Study Commission on Pharmacy, commissioned by the American Association of Colleges of Pharmacy and now so well known as the Millis Commission, along with congressional and administrative planners in the government recognized that increased manpower supply was not enough. New skills, abilities, and roles for pharmacists would be needed to deal with a health care demand radically different from that ever seen before—a situation dominated by an aging population whose sheer numbers and proportion of the whole could be overwhelming.

Born of this was the Federal Capitation Program, which helped finance a major increase in pharmacy college enrollments and output and, very importantly, introduced patient orientation, knowledge distribution, and "clinical pharmacy" into the educational model.

Pharmacists entering the profession today are different. They do have new knowledge and skills, and they can be a powerful force in their own right to effect change and to impact on the profession and the health care delivery system. Regrettably, however, this impact has yet to be seen or felt in a meaningful way in the ambulatory sector, where fully 80 percent of prescription drug use takes place. This is because: 1) the number of such new pharmacists is still a minor quantity in the total population of practicing pharmacists; 2) the institutional field has absorbed most of the patient-oriented new breed of pharmacists; and 3) the administrative policies of government programs in applying misdirected cost controls force even the most zealous pharmacy owners or managers to limit or curtail severely the non-dispensing activities of their personnel.

A country the size of the United States naturally deals with statistics of tremendous magnitude whenever it attempts to describe in the aggregate any particular activity. I will not bore you with figures showing the billions upon billions of dollars spent on this or that part of our health care delivery system; those aggregate figures serve little purpose other than to boggle the mind.

Unfortunately, not enough attention is paid to exactly where the year-to-year increases in these costs occur, which is the key to where and how to control or contain costs. Prescription drugs constitute less than 10 percent of the total health costs in America, and year after year these costs either have remained constant or have increased at a rate well below that of other segments of health care or of the economy as a whole. Further, there is tremendous cost containment potential in health care in general as drug therapy is made to work more effectively and efficiently.

Nonetheless, prescription drugs and pharmacy services receive the major attention of bureaucratic cost controllers. For example, America is currently in the middle of a generic drug business cycle due to run its course over the next five to ten years. Convinced that the minor savings per prescription gained by mandatory substitution of interchangeable drugs will impact significantly on the one-quarter of a trillion dollar annual cost of health care, drug product choice from amongst multiple suppliers is dictated more and more by government regulation.

Neither the physician, the pharmacist, nor the patient actually makes the product selection under these circumstances; drugs are selected by government edict. The consequences are professional as well as financial, for pharmacist/physician/patient dialogue and consultation are minimized or eliminated as the requirements increasingly become predicated on the lowest cost item. A threat to drug quality is inherent in this approach.

Pharmacy practice in the United States today can be characterized as highly diverse and extremely pluralistic. This is a reflection of the nature and character of a nation of 225 million heterogeneous and highly mobile Americans. The diversity and pluralism is an outgrowth of pharmacy's response to the dynamics of a predominantly private enterprise system now being modified by the dictates and parameters of public programs.

It is estimated that there are approximately 135 million ambulatory prescription users in the United States. These individuals disperse themselves over a wide range of ability and desire to pay for drug products and pharmacy services. Some are at one extreme, seeking the lowest possible cost. Others will not hesitate to spend whatever may be required to obtain the ultimate in service and quality assurance. Most users, assuming the distribution to be normal, range widely as they seek an appropriate accommodation of needed and desired services versus costs.

These 135 million prescription users in the ambulatory sector also disperse themselves over a scale relative to the severity of their illness condition. This, too, will introduce a considerable amount of variation in the need for professional pharmacy services above and beyond the dispensing of the drug.

Pharmacy services, then, are provided in a host of environments. In the institutional sector, there is a wide range of hospitals, nursing homes and extended care facilities. Seventy percent of the hospitals are private, not for profit; the remainder are either federal, state, county, or city tax-supported institutions or are so-called "for profit" institutions. Some, but not all, hospitals have outpatient departments or satellite clinics providing prescription drugs and pharmacy services to ambulatory patients. In the large metropolitan areas, and to some extent in some rural areas, there are neighborhood health centers which may provide prescription drugs to their enrollees.

The hospital field in general, because of its tightly-structured system for health care delivery, has quite readily accepted the pharmacist in the new role of drug information expert. There is excellent rapport between pharmacists and the other health care professionals, and the counsel of the pharmacist, who is broadly accepted as an expert on therapy and therapeutics, is sought at all levels. There is excellent data and information exchange between all parties concerned. More and more, pharmacy services are provided on a 24-hour basis, and many hospitals have decentralized the pharmacy service to their individual wards and floors.

In the noninstitutional ambulatory sector, where some 80 percent of prescription drug use occurs, the two general categories of pharmacy establishments are the independents and the chains.

Chains, by definition, are any four pharmacies under one owner. Some of the large corporate chains in America number more than 1,000 pharmacies. While the chain drug industry now commands well over 50 percent of total retail pharmacy sales, its proportion of the total prescription activity is less than that figure.

There is great variation in the types of independent pharmacies and the services rendered by them, as is also the case among the chains. As mentioned before, this variation exists to accommodate the needs, desires, and economic power of a varied local clientele.

Health maintenance organizations, which are fundamentally group practices, may or may not involve an integral pharmacy service. Some health maintenance organizations work contractually with pharmacies which are not officially part of the HMO, while others operate their own pharmacies. HMOs are a growing phenomenon in the United States but have not reached the level that was projected or expected when the concept first originated some years ago.

A number of mail order prescription services are available, particularly for retired individuals. Persons who suffer from chronic disorders and utilize maintenance drugs tend to make use of these services because of the economies of scale and the resultant lower prices available to them.

The economics of pharmacy practice are varied and are highly competitive as a consequence of general inflation, constraints in the third party pay area, and a general lowering of the economic base of pharmacy by drug product cost control programs and arbitrarily set dispensing fees.

The practice of pharmacy in the community has increasingly become more complex and complicated as a result of third party programs with their ensuing paperwork. Requirements of state formulary and drug interchange laws foster the use of generic drugs under very controlled conditions, adding to the complexities of practice.

While nursing homes and extended care facilities are generally considered to be part of the institutional sector, many pharmacists in the community setting have become the principal providers of pharmacy services to nursing homes. In addition, many pharmacists serve as consultants to these nursing homes. This function is providing new professional and financial opportunities for an increasing number of pharmacists.

This is an extremely dynamic period for pharmacy, and it appears that the 1980s will bring some further interesting changes for the profession.

The consumer movment in America now has gone through its adolescent stage and has entered maturity. While costs of prescription drugs are still important, there is evidence to indicate that cost is no longer the major consideration of most patients. Americans are being urged from many quarters to take a greater personal responsibility for their own health, both in the form of preventive medicine and in the form of seeking advice from a health practitioner before deciding on any particular course of treatment. We are urged, for example, to seek second opinions whenever surgery is indicated.

Consumers' rights have been well established, articulated, and put into place: the right to safety; the right to knowledge; the right of choice; and the right to be heard.

The right to choice is especially well-established and is the basis for the pluralism and diversity described before. The right to knowledge, which in the earlier days of the consumer movement centered mainly on costs and prices, is shifting now to the need to know about the action of drugs and to other personal considerations involving the patient. The right to safety, always a major factor, again is becoming the predominant consideration. The emergence of the right to safety and the right to know in the consumer movement at this time synchronizes well with the influx of patient and knowledge-oriented pharmacists who possess communication skills.

The subject of manpower levels to meet the continuing growth in the demand for prescription services from now into the third decade of the next century is of serious concern. The number of pharmacists currently entering practice versus those leaving is near an equilibrium and is likely to remain so for the next few years.

A new demographic factor now clearly entering the trend lines can have ominous repercussions for the future: America's birthrate began to drop sharply in 1960, and what may have been perceived at the time as a temporary phenomenon has become strong and pronounced. In the 1980s, there will be 25 percent fewer college age individuals in Massachusetts than there were in the 1970s, and the drop will exceed 40 percent by 1994. As demand for prescription services increases with the aging population, and as the rate of attrition among current pharmacists accelerates, it is quite likely that there will be a severely reduced influx of pharmacists in the latter part of this decade. The demographic shortfall is manifesting itself now in many entering college classes.

This significant trend is currently obscured, as the tendency is to focus upon the large enrollments and output of the past decade. Government manpower projections seem to have missed the significance of the birthrate decline, and their data soon will have to be revised radically.

The nation will make tremendous demands upon the shrinking pool of educated young people, and pharmacy is but one of many fields that will vie for needed replacements. There is excitement and challenge ahead for pharmacy in the United States. As a profession, it has withstood well the onslaught of change. It will again in the decades to come.

# PHARMACISTS' KEY ROLE IN NEW DRUG DEVELOPMENT, TESTING, AND USE

By **Jere Goyan, Ph.D.,** Commissioner, United States
Food and Drug Administration, Rockville, Maryland,
U.S.A.

I am delighted to be here today. I think that you are here at a particularly significant time in the unfolding of the history of therapeutic drug development. I have said several times recently that I anticipate that the next few years will see a real increase in the number of new and important drug entities released in the United States. As you are undoubtedly aware, from time to time our agency has been accused of slowing down the rate at which drugs are approved in the United States. In view of the fact that it appears that there will be many approved over the next few years, I fully expect that we will take full credit; however, I doubt we will get it.

I believe that humankind has benefited enormously, to a degree that the industrialized nations only dimly understand, from what I consider to be the first wave of therapeutic drug development. That wave began during the period of World War II, when, for the first time, drugs became available that actually could cure disease — a development that helped the world toward a common goal as age-old enemies of humankind were attacked and defeated. Infant mortality, the ancient sorrow for the developing nations, was the first joyful index of the powerful effectiveness of our new drugs. Today, tens of millions live who would have perished without the aid of those drugs.

As I said a few moments ago, I think we are now poised at the beginning of a new wave of power and specificity that would have been incomprehensible even a few years ago. Biochemistry and genetics have linked forces to pierce the mystery of recombinant DNA, and now science holds in its hands a truly god-like power of creating new forms of life designed to redress the deficiencies and diseases of the old.

Ours, then, is the challenge, whether we be scientists, administrators, journalists, or manufacturers, to find the best possible way to use the power we now possess and the even greater power we are certain to secure. For the fact too often obscured by our understandable desire to link possibility with actuality, to perceive the new ends in the means, is the need to accept the benefits with adequate consideration of the risks. Modern medicine, like the fire that Prometheus stole from the gods to benefit humanity, can create — and it can destroy. No medicine, even the most beneficial, is without risk. Thus now, more than ever, we must find ways to see the delivery of these marvels without being so cavalier about their benefits that we do not consider or adequately control their risks.

The United States through the years has developed elaborate systems to secure these dual ends. Ours is but one way of many, and our way of regulating the movement from innovator to consumer of new drugs reflects our own nation's situation, which does not involve centralized health care but which does involve a diverse, individualistic system spread over a huge area. Other methods are, of course, employed by countries with different systems and, for such nations, are effective.

So I am not here to say that you should follow our lead in how we regulate drugs but only to ask that when you consider new medicines, take extra precaution. We all must realize that medicines today are too powerful and too important to be left to the vagaries of chance distribution and purely commercial calculus. It is important that pharmacists play the key role in any nation relative to the development, testing and use of new drugs.

I trust that the conference here in Boston will assist pharmacy educators in developing curricula which will produce pharmacists who meet these needs throughout the world.

I wish you the very best.

# EDUCATING PHARMACISTS FOR INSTITUTIONAL PRACTICE IN DEVELOPING COUNTRIES

By **Marilyn F. Harris, Ph.D.,** Associate Professor, Duquesne University School of Pharmacy, Pittsburgh, Pennsylvania, U.S.A.

Much has been said in the past several sessions about what is happening in the developed countries. My remarks will focus on some of the current issues in educating a pharmacist in developing countries. Are the issues in developing countries different from those in developed countries? Educating the pharmacist to meet best the health needs of the society in which he or she practices is the aim we all share. The different levels of resources and order of priorities, however, may result in different solutions to problems in the developing and developed countries. I will give you few answers, but I hope I will stir you to look at the issues and solve them, each in your own way, to meet your needs best.

A carbon copy of one of the American or European programs may not be—in fact, I suggest, is not—the best education for all pharmacists. I have selected three issues which I feel are important in the education of pharmacy personnel in developing countries. These three issues are:

1. How can we, as educators, develop programs for teaching pharmacists to meet the current duties they must perform and the future duties they are likely to perform?
2. Can the shortage of pharmacy educators in developing countries be alleviated?
3. How can we, as professionals, influence our national government and international agencies to make better use of the contribution pharmacy can make to improve health for all people?

Most of my examples will be taken from the Commonwealth Caribbean, or, if you prefer, the English-speaking Caribbean. I believe this area represents a microcosm of many of the problems encountered in other developing areas. Although many of you of the Third World already have solved some of those problems, Professor Beckett, when asked which problems should be tackled first by Federation Internationale Pharmaceutique (FIP), identified four problems.(1) Two of these problems deal with education: 1) help should be provided to develop pharmaceutical education in those Third World countries that need it, and 2) graduate programs in developed countries should be broadened to insure that students from developing countries are sufficiently qualified to do a good job when they return home without compromising quality. His fourth point identifies the need of FIP to stress greater pharmaceutical input and less medical input in pharmaceutical matters in dealing with the World Health Organization (WHO). His answer is well taken in reference to the needs in the Caribbean and my experience at WHO.

## PHARMACY EDUCATION

### Program Development — A Case Study — The Commonwealth Caribbean

There are four training programs for pharmacists in the Commonwealth Caribbean.(2) These programs are located in Jamaica, Guyana, Trinidad/Tobago, and Barbados. A 1973 UNDP report dealing with the health manpower needs for the region recommended these countries as regional training centers.(3) In all four countries, the majority of medical care is delivered by the government, with only a small amount of nongovernmental input in the form of private health care institutions. Table I summarizes information about the various programs currently offered.

All four programs require for entry either three or five ordinary-level (0-level) passes of the General Certificate of Education (GCE), with two exceptions: Trinidad/Tobago also requires one A-level pass in chemistry; Barbados offers as an alternative a pass in the "pre-Health Services Program", a 36-week program to supplement the general education of potential health workers, which includes English, mathematics, biology, physics, chemistry, and social studies. Three of the four programs in the region are three years in length. Barbados has a two-year program. The length of the academic year varies considerably, as does the amount of class and laboratory time per year. The University of Guyana (UG) and the College of Arts, Science and Technology (CAST) in Jamaica award a diploma, while the Barbados Community College (BCC) awards a certificate. Trinidad/Tobago makes no formal award, as the program is offered by the extramural department of the University of the West Indies (UWI). Each program offers the usual range of coursework—general chemistry through pharmaceutical chemistry, biology through pharmacology, pharmaceutics, forensic pharmacy, and some form of business aspects. Jamaica has attempted to implement some clinical related training, and Barbados has added medical terminology, psychology, and disease states.

The programs in Guyana and Trinidad/Tobago both require concurrent employment in a pharmacy, and late day or evening classes. Trinidad/Tobago's program requires substantially less coursework than the other three, and at this time it is an evening program. The Barbados program requires completion of a controlled internship in addition to the two-year program; this internship is a six-month rotation—two months in each of community pharmacy, hospital pharmacy, and manufacturing pharmacy.(4) One month of the internship in Jamaica is a clinical clerkship;(5) the balance of the practical experience is not under the college's jurisdiction. In the other two programs, no part of the internship is under the control of the colleges.

All of the Caribbean programs, especially the Barbados program, were developed not only to meet the health manpower needs of the country but also to serve as a regional training center. The Barbados program serves as a regional training center for the Eastern Caribbean, and students from the Lesser Developed Countries (LDC) in the region make up about one-third of the student body. There is, however, some reluctance on the part of the LDC to continue sending students to Barbados; they fear the students will not return to their country but instead will remain in Barbados, where the economic picture is brighter.

For the first several years, most of the students from the LDC were supported by WHO fellowships. The LDC governments feel that as a result of a proposed loss of the WHO fellowships in the near future, it would be less expensive to develop their own programs than to send students to Barbados. This attitude, however, shows a lack of understanding of pharmacy education requirements. Some of the LDC government officials indicate that the level of training offered in Barbados is too sophisticated for their area and that a less rigorous, shorter program would meet their requirements. These conflicting situations have led to much discussion in the region and to several program development proposals submitted to private foundations. The problem of regional cooperation seems to be a major one in developing sound academically-based programs which would meet a multitude of manpower needs at different levels of pharmacy.

All four of the countries with established pharmacy programs plan to upgrade them. These programs have had support from project HOPE in supplying a pharmacy educator, from UNICEF in supplying equipment, and from WHO in supplying fellowships. The Caribbean Pharmaceutical Association has been revitalized, forming a medium for exchange of ideas within the region. In 1974, the Commonwealth Pharmaceutical Association decided that the minimum world-wide registrable level is the bachelor's degree in pharmacy. This decision, which has wide support from the Caribbean pharmacists, may help to stimulate efforts to establish and maintain a regional faculty of pharmacy based on solid education principles.

## Pharmacy Practice Considerations

Regional Pharmaceutical Policy. The recognition of the substantial cost of drugs has led many countries to develop systems for the control of this expenditure. One such action to attempt this type of control was the report "Towards a Regional Pharmaceutical Policy", prepared by the United Nations Action Program for Economic Cooperation among non-aligned and developing countries (UNAPEC).(6) This proposal was endorsed by the Caribbean Health Ministers at their annual conference in St. Lucia in July 1978.

The UNAPEC proposal for a national drug policy in each of the countries includes:

1. preparation and use of national and regional formularies;
2. strict monitoring of all OTC pharmaceuticals on the basis of therapeutic efficacy and cost;
3. generic prescribing and dispensing;
4. pooled procurement;
5. effective inventory control and forecasting;
6. regionalization and coordination of drug manufacturing; and
7. a complementary emphasis on local production in hospital pharmacies and elsewhere of as many items as is feasible within the limits of the equipment and facilities available. In developing educational programs for this region, it would, therefore, be necessary to consider the skills needed by the pharmacists to implement such a program. Such questions as whether all pharmacists need all the skills necessary for

such a program or whether specialized or post-graduate training would be needed by a few pharmacists with the majority of pharmacists requiring completion of a basic program must be answered.

National Health Service (NHS). Barbados is planning to implement a NHS in 1980.(7) The first part to be implemented is the Drug Plan. This plan will supply drugs for indigent patients, children, and those over 65 without charge; others are to be included on a fee basis at a later time. The Drug Plan will require substantial continuing education for the currently practicing pharmacists, as well as some revision of the training program for pharmacy students at the BCC. Much of this plan has aims similar to those of the UNAPEC plan. In addition, the NHS plan, with its strong emphasis on primary health care, opens another area where pharmacists could provide a much needed service. The NHS plan would be implemented through a number of polyclinics where all types of primary care could be obtained under one roof. At each polyclinic, there will be two or three general medical practitioners with their primary health care teams. In addition, certain special services would be offered, such as dental care, selected specialty clinics (e.g., for diabetes or hypertension), psychiatric care, public health, laboratory, and pharmacy services. Potential exists for the development of pharmacy service which would include many clinical pharmacy functions.

Drayton, project manager of the PAHO/WHO Regional Allied Health Project,, in a presentation to the Caribbean Association of Pharmacists in 1978, described the needs for clinical pharmacists in the Caribbean.(8) He recommended that clinical pharmacists should be attached to the ministry of health as advisors to the government's chief pharmacist for providing drug information and for drug utilization review, and to each major hospital—especially those involved in clinical drug trials and those most actively involved in the basic or clinical education of physicians. This was presented as an option for pharmacists as a professional track for their upward career mobility. Drayton estimated that, with a 50 percent leakage to developed countries, there was a need for about 30 persons with this specialized training. With the development of a NHS, more clinical pharmacists could be utilized advantageously as part of the primary health care team in each polyclinic, substantially increasing those projected manpower needs in the clinical pharmacy area.

## Competency Based Curriculum

In the United States, pharmacy education is being studied, and much effort is being put into developing a competency based curriculum. The APhA and AACP have completed an inventory of responsibilities of pharmacists and recommend use of the inventory in constructing pharmacy curricula.(9) The ACPE, the accrediting agency for colleges of pharmacy in the U.S., is asking that each school give consideration to a competency based program. This type of analysis involves an in-depth look at what the pharmacist does in the work situation and also some prediction of what the pharmacist of the future will do. The University of Minnesota has completed this analysis, and many other colleges of pharmacy either are doing their own analyses or are modifying the APhA or the Minnesota studies.

We in America currently are attempting to ensure that our programs are educating pharmacists to meet the needs of their current work situations and also to ensure that they will be capable of development to meet future demands. My description of some of the developments in the Caribbean is to give you some idea of the types of situations which might be studied when developing an educational program. As in most programs, they "put the cart before the horse". What is needed there, and perhaps in your country, is to take an in-depth, systematic look at what the pharmacist is doing and to make some educated predictions of the future. Many programs are developed by a biased group often not even substantially from that profession. This is especially true when large multinational agencies are involved.

The WHO recently published "Competency Based Curriculum Development in Medical Education",(10) a document which discusses competency based curriculum development in depth, using medical education as a model, but which in the foreword makes reference to its possible usefulness to other health professions.

Most of our countries are members of WHO. One global objective of the WHO is the promotion of improved standards of teaching and training in the health professions. A look at the WHO budget for 1974 shows that out of U.S. $211,590,204, 11.6 percent—approximately $25 million—is for health manpower development. For 1980-81, the total budget is $427 million, with undoubtedly a significant percent allotted to health manpower development. I suspect that, except for a very limited number of WHO fellowships, little of this money is designated for pharmacy education. The time may be right for a proposal from a developing country or a group of countries to study pharmacy and develop a CBC. We can sit back and wait for some other health professional to do it for us, or we can make our needs known, loud and clear, through our countries' representatives to WHO, our ministries of health, and any other interested international groups, such as FIP. Unless we make a cooperative effort, we are unlikely to receive any assistance from WHO.

## PHARMACY EDUCATORS

### General Problems

One of the most serious problems facing pharmacy programs in developing countries is the dearth of pharmacy educators. To pursue advanced study, it is frequently necessary for the student to leave his/her country and travel to a developed country. The program of study followed is usually a highly specialized, in-depth concentration in a narrow area, a type of program which may be inappropriate to the needs of pharmacy education in a developing country, especially one at the beginning stages of development. At the completion of the advanced degree, the student may feel unprepared to meet his/her country's needs, and, having been away for an extended period of time, he/she has adapted to another culture and is able to find employment easily using these specialized skills in his/her adopted country. This, together with the lack of recognition—both in prestige and monetarily, by some governments, increases the probability that the new graduate will not return home or, if he/she does, will enter the industrial area where there is more prestige.

### Health Science Tutor Programs—Barbados

When a UNDP Mission in 1973 surveyed the training needs for health personnel over a five-year period in the 17 English-speaking Caribbean countries, it was estimated that no less than 15 teachers of pharmacy would be required.(3) This requirement, along with the need for health profession teachers, resulted in the PAHO/WHO Health Sciences Tutors program based in Barbados.(11) This is a two-stage program. Stage I is a ten-month, post-basic program designed to assist health professionals in developing the knowledge, skills, and attitudes essential for effective teaching in community colleges, universities, and in-service ministry of health programs. Stage 2, which is also of 10 months duration, is more in-depth and deals with socio-cultural, political, economic, demographic and geographic issues. The student also will be able to design and implement research and participate in all phases of curriculum development. Both Stage I and 2 programs are certified by the University of Guyana; Stage I leads to a certificate and Stage 2 to a bachelor's degree in health science. For Stage I, successful completion of a basic level program and at least three years experience are prerequisites. Stage I is a prerequisite for Stage 2. Drayton states that this kind of non-generic degree structure is more relevant to the needs of the service situation in Commonwealth Caribbean countries than the traditional generic design starting at the GCE "O" and "A" levels and will provide that essential preparation for leadership which is needed so badly in the health care sector of these countries.

My observation, however, is that there are not enough basic level pharmacists presently trained, and there are none with three years experience. This training, although well designed for general health science, is not specific enough for training pharmacy educators to teach in areas other than at very basic levels. There is a need for training programs for teachers at a higher level than this program offers. The basic design of this program might be considered, but instructors in the program should be sufficiently expert in the specialty area as well as the general areas. This type of program also should be on a university campus and staffed by university instructors.

### Alternate Suggestions

The development of cooperative programs to train pharmacy educators is an area which should be explored. Cooperation between universities in several developing countries might be explored, using the strengths of each to provide the necessary expertise. This is an area where faculty from developed countries could participate on a rotating basis.

Another alternative might be for a university in a developed country to develop, in cooperation with a group of developing countries, a program designed specifically to meet the needs of these countries. Consideration might be given to offering part or all of such a program in the region for which it was designed. The university from the developed country could supply the faculty, perhaps on a rotation basis, make a short-term equipment loan, or approach international agencies or private foundations to supply basic equipment. One of the regional countries could provide the site. In this type of cooperative venture, the degree would be awarded by the university after the student completed perhaps only a minimum amount of time in the institution in the developed country.

We all must be aware of this problem and accept responsibility to explore all the possible alternatives seriously if we are to ensure an adequate supply of pharmacy educators for all countries. Professor D'Arcy, coordinator of FIP's Third World Project, presented to the members of the Bureau in March of this year a number of basic problems which are common to Third World countries. One of these is shortage of personnel. The June issue of the Bulletin d'Information will contain an article by D'Arcy which may give fresh ideas on solving this problem.(12)

## COMMUNITY HEALTH WORKERS (CHW)

### General Overview — A Case Study — China

Thus far, my remarks have been directed toward the education of pharmacists, although the level of training has varied. I would like now to direct your attention to another type of training that may be happening in your country. In this case, I will not use the Caribbean as my frame of reference, but the traditional area, China, when talking about community health workers, or "barefoot doctors".(13)

With the assumption of state power by Mao and the Chinese Communist Party in 1949, a national policy for improved medical care services was established. In the mid-1960s, the Cultural Revolution brought about additional significant changes in medical practice. Mao issued a directive, "In medical and health work, put the stress on the rural areas!" This resulted in the training of large numbers of peasants to provide environment sanitation, health education, preventive medicine, first aid, and primary medical care while continuing their farm work. Those peasant health workers came to be known as barefoot doctors in the rural areas near Shanghai, where much agricultural work is done barefoot in the rice paddies. Although the barefoot doctors wear shoes most of the time, especially while performing their medical tasks, the term is used to emphasize the fact that these personnel perform their medical work together with their tasks as farm workers.

I will not discuss the function of the barefoot doctors except where they deal with drugs. The barefoot doctor is empowered to use a wide range of traditional herb remedies, as well as antibiotics, epinephrine, reserpine and other powerful modern drugs; however, other drugs with great toxic potential, such as digitalis and adreno corticosteroids generally are not used by the barefoot doctor. The initial training for barefoot doctors, of whom there are now said to be more than one million, usually takes place locally for a period of three months, often in the commune hospital or county hospital. Subsequent continuing supervision and training periods are used to improve their knowledge and skills. The complex system of supervision and referral appears to ensure that there is adequate control of technical quality as well as rational deployment of manpower and access to services.

### The Need for Pharmacy's Input

The barefoot doctor concept, as the result of its relative success in China, has been adopted and adapted by a number of developing countries. The WHO, although not involved in the original barefoot doctor concept, has developed model programs and assisted a number of countries in establishing community health worker programs. Almost all of these community health workers supply patients with drugs. In some countries, these CHW are supplying drugs in competition with the pharmacists. This fact alone should indicate the importance for organized pharmacy to use its influence on governments to ensure that this situation does not arise.

Pharmacy can, however, have a more positive input on CHW programs. WHO is heavily supporting the community health worker concept, with approximately one-third of its budget going to strengthening health services, of which the training of community health workers is a part. We, as pharmacists and pharmacy educators, must exert our collective and individual influence on the development of training programs for these workers. Currently, many are using the training program developed by WHO. These programs, although the CHW use drugs extensively, are developed by health professionals other than pharmacists. To my knowledge, there are no pharmacists invovled in planning these programs. The FIP has made progress in becoming involved in discussions with WHO where drugs and drug policies are concerned.

It would benefit pharmacy if FIP and other international and national organizations can ensure that pharmacists are involved in the development of training programs for community health workers. Indeed, if pharmacy education is to be recognized by WHO, WHO must be made aware of our profession and its educational needs and the areas where we can contribute best to WHO's objective—"the attainment by all peoples of the highest possible level of health."

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Table I

COMPARISON OF PHARMACY PROGRAMS IN THE COMMONWEALTH CARIBBEAN

| | Entry Requirements G.C.E. Level | Length of Study Years | Practical Training Months | Number of Graduates per Year (approx.) |
|---|---|---|---|---|
| Jamaica (CAST) | 3 - 0 | 3 | 12 | 30 |
| Guyana (U.G.) | 5 - 0 | 3 | 12 | 10 |
| Trinidad/Tobago | 5 - 0 | 3 | 24 | 12 |
| (Extramural Dept.) (U.W.I.) | 1 - A | | | |
| Barbados | 5 - 0 | 2 | 6 | 12 |

# FORCES AFFECTING PHARMACY EDUCATION — AN INDUSTRY PERSPECTIVE

By **William H. Helfand, B.S.**, Vice President, Merck Sharp and Dohme International, Rahway, New Jersey, U.S.A.

The conventional wisdom in pharmaceutical education is that students are being groomed to follow one of two career paths: to become practicing pharmacists in the traditional sense or—for a select few—to pursue research either in an academic or an industrial setting. The pharmacist who aspires to another sort of career—particularly a non-research career within the pharmaceutical industry—must transcend his or her education. Paradoxically, in this age in which large companies have become the producers and distributors of sophisticated medicines, some of the most interesting and rewarding careers for which pharmacists are particularly suited require skills that are in no way cultivated—or, in some cases, even introduced—in their professional education. To the degree that the broad generalizing and humanizing skills needed for modern management can be superimposed on the highly disciplined studies that constitute conventional pharmacy education, society, business, and the students themselves will be better served.

As the professional schools increasingly recognize the key role performed by pharmaceutical companies in the practice of pharmacy, questions must be asked about the preparedness of pharmacists to contribute effectively to this role. Once these questions are asked, it becomes immediately apparent that not one, but two career pathways exist for pharmacists in industry: research and management.

The research career pathway is well recognized and fairly well established in many countries. This pathway consists of formal, advanced systematic education in the scientific and technological areas, and it leads to a career in research or in the more technical aspects of product development, manufacturing, and quality control.

The second career pathway, management, is less well recognized than is research, and it deserves far more attention than it has received until now. This pathway is aimed at high ranking management positions in industry.

Several ironies are evident to the managers within the pharmaceutical industry who look to the pharmacy schools as a source of talented young men and women who might wish to pursue a non-scientific professional career with them.

First, the pharmacy graduate, especially in industry, needs to possess and demonstrate skills in management while progressing up the ladder of advancement. As a student, however, beyond some studies in pharmacy administration, he or she receives little or no training in management techniques.

Second, the pharmacy graduate is an expert on pharmaceutical sciences who is expected to be able to instruct and lead others in these areas; yet, pharmacy education is deficient in the development of communication skills.

Third, in his or her university years, the pharmacy graduate went through a rigorous selection and training process and was instilled with a high degree of professional pride. In many cases, this elan loses vigor as time goes on, usually because there was insufficient guidance on ways to make the best use of his or her training.

These ironies deserve close inspection.

In certain countries, including France and South Africa, there still exists a legal requirement that a pharmaceutical manufacturing operation be managed by a person with a pharmacy degree. Despite this demand, no importance is given at the undergraduate level to courses in management. In France, an undergraduate may spend three months in industry prior to graduation; that is all. For those seriously pursuing management careers, post-graduate study in business administration would be necessary. Not surprisingly, such a program is becoming an increasingly important means of overcoming the deficiency in general management skills. In South Africa, too, this scant attention to the field of business management training is the biggest weakness in current pharmacy education; however, it plays a vitally important role in industry due to the legal requirement that the managing director of a pharmaceutical concern must be a pharmacist. Commentators in other countries also consider the lack of management training for the pharmacy graduate to be conspicuous.

The need for better communication skills for pharmacists entering industry is one of the most important of all considerations. Pharmacists are currently well equipped to obtain entry level positions in industry in a number of disciplines, including marketing, sales, production, quality control, and trade relations. As we all know, once a pharmacist begins to develop in a single functional area, only a small share of his or her scientific training is actually used. This is not a condition unique to pharmacy graduates; however, pharmacy programs do not seem to stress certain concepts which underlie effectiveness in these varied disciplines, such as the basic abilities to communicate, to project ideas, and to motivate and convince others. Above all, the executive in industry—as elsewhere—must be able to write clearly in his or her native language. The pharmacist in industry should possess these broad communication skills, as well as understand the concepts and techniques of general management.

Obviously, this also has application not only in industry but also in community pharmacy, in government service, and in other careers that may be chosen.

As an example of such a need independent of the industry, an interesting innovative idea is being tried in Holland. There, pharmacists invite groups of physicians to monthly or weekly sessions in which they discuss such matters as new drugs and the latest disease treatments. This is a first-rate use of communication and one that provides a forum for the exercising of good communication skills.

For students considering careers in industry, there is also an urgent need for the development of techniques to integrate knowledge from a wide variety of fields. An excellent background for this is familiarity with the historical, economic, social, and political context of the pharmaceutical world. A background in the history or the sociology of pharmacy provides for an understanding of the various forces that have led to developments in the past. The stress on this broad cultural background gives careers a perspective that can overcome too detailed attention to scientific and technological matters. Integrating the diversity of experience provides excellent training for the breadth of scope that is mandatory in a general management position.

Earlier this year, several speakers at a pharmacy conference in the United Kingdom emphasized the need for greater emphasis on communications. Graduates, one speaker commented, demonstrated "an almost total inability to communicate what they knew".(1) Perhaps the most outspoken critic was S.S. Davis of The University of Nottingham, who said that too much time in pharmacy undergraduate courses was spent in learning to pass examinations rather than in gaining an understanding of the matter being taught, with the result that "students were often better at thinking and understanding when they entered the course at year one than when they left three years later."(2) Future pharmacists, Davis continued, should be helped to communicate effectively and with the same confidence as physicians. He had heard that medical students' first few lectures were on "how to be arrogant"—and he speculated whether pharmacy students might not benefit from similar instruction.

Pharmacy colleges do instill a high sense of professionalism and prestige among their graduates (even if they do not reach the point of arrogance postulated by Professor Davis). A number of surveys have confirmed that pharmacists are considered well positioned among other professionals, including physicians, engineers, and lawyers. In Australia, where entry into professional training is based on academic standards, the requirement in some schools is close to that needed for medicine and veterinary science and higher than that for law, architecture, engineering, and science. In the United Kingdom, there is general agreement that current pharmaceutical education instills a proper sense of professionalism in its graduates; however, many graduates are thought to adopt a "defensive" attitude about their profession, compared with the more confident and aggressive professional attitude of physicians.

This apparently universal irony is the result of an education that does not match all of the exigencies of the real world. The value of the pharmacist's role is determined by the needs of society. As opportunities for the pharmacist open up in industry and government, these developments should be reflected in the curriculum; instead, the emphasis continues to be placed disproportionately on science and technology. As a consequence, the profession of pharmacy is one of the best educated and least used of all professions. Despite the pride instilled during their training, most pharmacists become frustrated several years after graduation when they realize that they are not able to use their education fully. This is especially true in the pharmaceutical industry, where, if there is need to diversify into other areas related to specific activities, the pharmacist finds the need to take additional courses to cover what is lacking.

Clearly, pharmacy graduates have not been completely or hopelessly handicapped in business by these shortfalls in their education. Opportunities for pharmacists in industry today are greater than is generally known or recognized in the curriculum. The Australian Pharmaceutical Manufacturers' Association recently obtained from 32 companies data on the positions and career pathways of 87 pharmacists working for them. The results of this survey showed that the greatest number—18 percent—were employed not in science, but in general management. Equal numbers, 13 percent each, were working in marketing, production, and product development. The survey also was able to reconstruct career paths for 34 of these pharmacists. Of the 13 who were then in senior management, none had started in administration. There were 8 pharmacists in marketing, 13 having started there; there were 9 in production, 5 having started there. Most interesting was the finding that only 4 pharmacy graduates out of these 34 were in the technical/scientific area, although 16 of the total had begun in this area. The clear movement of these people was from the scientific and technical areas toward production, marketing and administration, more than one-third of them obtaining high-ranking positions in management.(3)

One possible development in Europe also should be noted in the context of the importance of general management training. Pharmacy education under the aegis of the European Economic Community (EEC) is going to be changed along certain broad lines. The scientific basis will be condensed, and after the basic period of study there will be specialization in such areas as dispensing, hospital pharmacy, and industrial pharmacy. There will be different examinations for each specialty and different certificates needed to practice in the different areas.

I have dwelt on only the second of the career paths, that of training for general management. Of course, there is also the potential for pharmacy graduates in the research and more technically oriented activities of pharmaceutical companies—the first of the career paths I mentioned. Here, the current undergraduate education, with its emphasis on science, is more relevant.

The scientific training provided in colleges of pharmacy in major countries is generally considered to be of high quality. A lot more needs to be done in order to match more closely the needs of industry with advanced degree courses in the universities, but there is a growing awareness that more interaction between the colleges and industry in this area is desirable and needed. There are many such examples of such interaction from numerous countries. One cooperative effort between industry and the pharmacy colleges in Australia represents a step in the right direction: There, a liaison committee recently published a brief pamphlet in which it set forth in concise form the pre-registration requirements and current curriculum of the pharmacy programs so that interested industry executives could see precisely what training currently is given in all of the colleges.(4)

Another example comes from the United Kingdom, where there is some funding pressure from government to bring together the research capabilities of industry and academia. The research funding organization, the Science Research Council, has demonstrated a greater willingness to support research projects undertaken in collaboration with industry than to support purely academic projects.

In the United States, the American Foundation for Pharmaceutical Education is serving as an effective bridge between industry and education in the area of scientific manpower needs. A year or so ago, the Foundation conducted a survey among pharmaceutical manufacturers to determine their most critical scientific manpower needs both in the immediate future and over a five-year period. It then granted a number of special fellowships in the areas of the most critical need and made the tabulations public so that students could see where the greatest demand would be in the coming years and plan their educational careers accordingly.(5)

Although there are a few non-Ph.D.s with splendid research positions and records of achievement, it is generally true that, because of the ever-increasing sophistication of pharmaceutical research, post-graduate scientific training leading to a doctorate is almost mandatory. The outstanding talents of pharmacists destined for these positions are generally evident early in their educational careers, and their paths of specialization are set accordingly.

The need in this area is well recognized, and steps are under way to make the system work more productively. The area which needs far more thought and effort is illustrated by the ironies discussed earlier—the gap that exists between the opportunities for a management career in industry and an educational experience all too lacking in the fundamentals to make these careers more accessible. The mutual interests of students, industry, and the colleges of pharmacy themselves would be well served by emphasizing in the curriculum courses designed to produce graduates who have a broader outlook than that of mere specialists.

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# EDUCATING PHARMACISTS FOR PRIMARY CARE ROLES

By **Eric T. Herfindal, Pharm.D.**, Chairman, Division of
Clinical Pharmacy, School of Pharmacy, University of
California, San Francisco, California, U.S.A.

Pharmacy education in the United States has undergone significant changes during the past two decades. The major thrust of change has been directed toward producing a pharmacist who can function as a consultant to health practitioners and patients and who can, thus, indirectly promote more rational and safe use of drugs. To a large extent, these efforts have been successful. The Study Commission on Pharmacy promoted the concept that "pharmacy should be defined basically as a system which renders a health service by concerning itself with knowledge about drugs and their effects upon human beings and animals."(1) In concert with this notion, the pharmacist's role has evolved into one with increased input into the therapeutic decision making process, patient education, monitoring of drug therapy, and the education of other health care providers. Although it is inaccurate to portray this role of the therapeutic consultant as a universally accepted phenomenon, it has been accepted with relatively little resistance in most acute care environments where it has been tried.

We now are beginning to see the development of what may be the logical evolution of the pharmacist as a consultant—the pharmacist as a direct provider. In primary care centers, family practice programs, medical specialty clinics, private physicians' offices, extended care facilities, and some acute care environments, clinically trained pharmacists are assuming primary responsibility for patient care.(2) Medical support for this role is evidenced in a statement by Dr. Robert Ebert, Dean of the Harvard Medical School:

> I see no reason why the pharmacist working with the physician might not assume primary responsibility for long term care of certain patients, particularly those requiring continuous drug therapy. . .The future of the pharmacist lies in the direction of clinical medicine and the education of the pharmacist must reflect this need. The pharmacist in training needs to have a greater exposure to patients, a better understanding of disease, and a greater opportunity to work with physicians in the direction of provision of medical services."(3)

There is no accurate source of information concerning the degree to which pharmacists are utilized in direct care roles. The literature contains numerous articles describing various practice arrangements and roles for pharmacists, but it is difficult at this time to determine whether this is a national trend.

My impression is that there is an increased tendency for clinical practitioners to evolve from consultants into direct providers; however, it is a very rare occurrence for a clinic or group practice to recruit a pharmacist specifically for this role unless it had been established previously by another pharmacist. This is, of course, the same situation we had when the role of the pharmacist as a consultant was first promoted. The pharmacist's main function then revolved around drug distribution, and the expansion of duties was directly proportional to the pharmacist's skills and competence and the receptivity of the physicians.

## PRACTICE ROLES

Although it is difficult to generalize about the economics, quality, and extent of involvement of pharmacists in direct patient care today, it is possible to define some broad areas which can be of help in determining the educational needs of these practitioners:

1. Triage

   This is defined as "the sorting of patients' problems to identify the health care resources to meet patients' needs".(4) Although community pharmacists can claim that this base has been a traditional role for pharmacists, the triage functions of pharmacists in primary care are much more comprehensive. Pharmacists practicing in the Indian Health Service, for example, function as physician extenders by screening patients and treating certain chronic and self-limiting conditions under protocol.(5) In most other sites, pharmacist involvement in triage is not as extensive; it is more common to have nurse practitioners or physician assistants perform this function.

2. Patient Education

   Patient education is recognized as a significant factor in health maintenance. This is particularly true in regard to drug therapy. Although the factors that contribute to non-compliance are complex, there is evidence that pharmacists can improve compliance by counseling patients about their drug therapy. In many cases, pharmacists have developed printed and audio-visual materials to augment the educational process. Pharmacists practicing in primary care environments devote a significant amount of time to this activity on an individual basis or in groups.

3. Consultations

   Pharmacists practicing in primary care sites consult with the medical and nursing staffs on pharmacotherapeutic problems. In addition to patient-specific problems, they typically assume a key role in formulary development, drug utilization review, medical audits, in-service education, and clinical research involving drugs.

4. Refill Authorization

   A relatively new concept is the emergence of refill clinics or pharmacy clinics. The degree of independence exercised by pharmacists in these situations varies. In some centers, pharmacists assume continuing responsibility for the monitoring of patients on chronic drug therapy; in other places, the pharmacist is only empowered to refill prescriptions between regular appointments with the physician. In the former instance, the pharmacist performs a physical examination in addition to ordering appropriate laboratory tests to determine the status of the patient: if the patient is progressing satisfactorily, a refill of the drug is authorized by the pharmacist; if a change in drug therapy is advised, the patient is referred to a physician. In the latter case, the pharmacist has less independence and generally does not perform a physical examination or order laboratory tests; the judgment is based upon information from the chart, the general appearance of the patient, the timing of the next scheduled appointment, and the compliance of the patient with the regimen.

5. Prescribing

Until recently, it has not been legally possible for pharmacists to prescribe drugs other than those not requiring a prescription. Now, under various programs such as the Experimental Health Manpower Program in California, we will be able to analyze the appropriateness of this as a role for pharmacists. Under this program, specifically trained pharmacists are authorized to prescribe drugs from a formulary developed for each site. The pharmacists have been trained to perform certain physical assessments and have passed competency examinations in therapeutics, pathophysiology, pharmacology, and drug information retrieval and analysis. Within the next two years, we will have data on the quality and cost of this role for pharmacists. Under less structured situations, pharmacists in many other states are assuming responsibility for the postdiagnostic medical management of patients whose primary mode of therapy is drugs. For example, it is becoming increasingly common to see pharmacists practicing in anticoagulation clinics, hypertension clinics, diabetic clinics, family practice programs, and others.

In addition to these roles, many pharmacists are also responsible for the dispensing of drugs, the maintenance of patient profiles, and the education of pharmacy students and residents.

## COMPETENCIES

Although there is great variability in the practice patterns among pharmacists in primary care, there are certain competencies which appear to be required. In an effort to identify these competencies and to develop appropriate educational programs, we designed the following study:(6)

A panel of pharmacists practicing in primary care was asked to submit a list of competencies (utilizing behavioral terms) which best described their roles. These competencies then were assembled and edited and subsequently were distributed to the panel at a working session. Each individual was asked to assign like competencies into categories. By a process of consensus, the group then agreed on major categories and the placement of individual competencies within those categories. Over a period of three months, the competencies were refined further utilizing two other panels of practitioners. Narratives defining pass, fail, and anchor points were developed utilizing all three groups of pharmacists. By eliminating confusing, ambiguous, and redundant competencies, we were able to identify 28 characteristics on which all three groups of pharmacists agreed. Furthermore, we were able to classify them into five major categories:

1. Patient management;
2. Communication;
3. Health systems management;
4. Therapeutic knowledge base; and
5. Literature evaluation.

The specific competencies identified were as follows:

### Patient Management

1. Able to elicit successfully during a patient interview all of the following: a list of current drugs and dosing regimens, a list of pertinent past

medications, and a list and description of any allergy or adverse side effects; and able to assess the patient's compliance with drug therapy and the reliability of the information obtained.

2. Able to design successfully a practical therapeutic regimen with appropriate monitoring parameters and with well-described alternatives which are based on patient-specific information.

3. Able to obtain the appropriate historical, laboratory, and physical data necessary to evaluate the status of the patient and his/her responses to the therapeutic regimen. Able to assess patient symptoms that may relate to drug allergies or sensitivities, incorrect administration, side effects, adverse effects, or toxicity.

## Communication

4. Can effectively develop and utilize patient counseling aids to instruct patients in proper medication usage and storage.

5. Informal and formal therapeutic consultations are complete, i.e., concise and include a statement of the question, discussion, conclusion, summary and appropriate references.

6. Always includes information on the safe and efficacious use of drugs when counseling patients, physicians and other health professionals.

7. Reacts to others' problems in a sympathetic, sensitive manner but does not let emotions dictate comments or promises which cannot be fulfilled.

8. Always communicates with patients and health professionals with clear, concise, reasonable, and complete responses.

9. Verbally communicates at the appropriate level for the audience.

10. Critically evaluates for risk versus benefit of all medications currently prescribed or about to be prescribed (including rationale for use, efficacy, toxicity, side effects, adverse effects, drug interactions, pharmacology, and pharmacokinetics) and compares them to alternative therapy.

## Health Systems Management

11. Able to describe and discuss fully the different roles and patient care responsibilities of all health care professionals, e.g., physician, nurse, social worker, physical therapist, psychologist.

12. Able to list, demonstrate, and discuss the exclusive and shared roles of the clinical pharmacist in an interdisciplinary team.

## Therapeutic Knowledge Base

13. Can always identify, list, and assess all the appropriate parameters (physical, lab, etc.) for monitoring the progress of drug therapy for the stated disease states.

14. Can always (state) identify the effects of drugs on laboratory test results and physically measurable parameters.

15. Can readily (list) state and indicate the significance and incidence of common adverse reactions and predisposing factors, and is able to state how to avoid or minimize them.

16. Can identify through observation of patient response, common adverse drug reactions and interactions.

17. Can readily identify and list patient risk factors that will influence therapeutic outcome.

18. For each stated disease can always identify the drug of choice,

dose, frequency, and duration of therapy, and alternative choices where appropriate.

19. Can list the considerations important in selecting drug therapy in each disease state and the factors which may necessitate alternative therapy.

20. For each drug selected, demonstrates ability to select appropriate product; considering dosage form, palatability, cost and generic equivalence.

21. For a given drug can select and utilize appropriate biopharmaceutic and pharmacokinetic data to establish a drug regimen.

22. Always demonstrates the ability to counsel patients concerning the use of OTC products in the treatment of acute self-limited disease (cold, athlete's foot, sunburn, etc.).

23. Can state the relationship between the physical and laboratory symptomatology and the disease process (e.g., BP, urine proteins, and RBCs, renal disease).

24. Can recognize the physical and laboratory symptomatology of the diseases commonly seen in the delivery of ambulatory care.

25. Can readily list the diagnostic procedures commonly performed in the stated diseases usually seen in the delivery of ambulatory care.

26. Is able to discuss with patients, staff concepts and principles in preventive medicine (e.g., VD prevention, compliance, drug abuse).

Literature Evaluation

27. Can evaluate and present drugs and new drug information and develop recommendations for their place in conventional therapy and support recommendations.

28. Can evaluate and critique drug literature, published studies, and protocols, and point out strengths and weaknesses regarding reliability, reproduceability and significance of results.

It is evident that a majority of these competencies are required in most practice environments and not only in primary care. This may explain why it has been possible for many pharmacists to evolve from consultants into direct providers of care with little additional training. I believe we are fast approaching the time when all pharmacy students will receive some training in physical diagnosis.

The availability of specific competencies and behavioral rating scales provides us with a framework for curricular design. If the current trend continues, more of our graduates will assume roles as direct providers of care. Few schools currently require students to demonstrate communicative skills and to perform simple physical assessment procedures. These skills should be common to all health care providers, including pharmacists.(7)

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## EDUCATION FOR INSTITUTIONAL PRACTICE

By **Clifford E. Hynniman, M.S.**, Immediate Past President, American Society of Hospital Pharmacists; Associate Professor, College of Pharmacy, University of Kentucky; Director of Pharmacy, Norton-Children's Hospitals, Inc., Louisville, Kentucky, U.S.A.

When one reviews the literature and college catalogs, considers the abilities of current graduates, and recognizes the increased efforts directed toward postgraduate training and continuing education, the obvious conclusion is that colleges of pharmacy do not educate for institutional practice.

In considering this topic, it seems appropriate to ask, "What do we mean by 'educating for institutional practice'?". At one time, the word "institutional" was assumed to mean "hospital". Today, institutional practice is applied to all organized health care environments, including hospitals, clinics, long-term care facilities, primary care centers, and many others. Many of these areas require highly specialized or differentiated pharmacy practitioners. Because of the broad base of requirements to prepare practitioners in these areas, one could review the entire curriculum to determine the contribution of each course toward educating pharmacists for institutional practice. On the other hand, there is increasing recognition that the level of competency required of pharmacists for effective practice in these areas is not generally attained through college educational programs.

The AACP has recognized that the curricula of colleges are directed toward the preparation of undifferentiated pharmacists having sufficient competency to be licensed for contemporary practice.(1) Further, since the great majority of graduates pursue careers in community pharmacy, any differentiation that occurs at the undergraduate level favors this area. However, there is a body of opinion that suggests curricula do not provide even minimum competency for community pharmacy practice in some areas, e.g., management.(2)

The ASHP's guidelines on the competencies required in institutional pharmacy practice endorsed by the AACP cover seven broad areas.(3) While a thorough knowledge of drugs and their actions is fundamental to the institutional pharmacist's contribution to health care, it is unlikely that the broad range of expertise described in these guidelines will be possessed by any single individual. An effective practitioner should have an appreciation for all of the competencies and, indeed, should possess many of them.

These seven areas are:

1. effective administration and management of a pharmacy department in an institution;
2. assimilation and provision of comprehensive information on drugs and their actions;
3. the development and conduct of product formulation and packaging programs;

4. conduct of and participation in research;
5. development and conduct of patient oriented services;
6. conduct and participation in educational activities; and
7. development and conduct of a quality assurance program for pharmaceutical services.

A careful review of this document would indicate clearly that the undergraduate curriculum does not prepare pharmacists for the appropriate level of competency in all of these areas; however, most curricula contain many courses which contribute to at least an awareness for a minimum level of competency in the seven areas just mentioned. For example, to correct the common deficiency most graduates have in the area of parenteral products, aseptic technique, and IV admixture programs, some colleges offer elective practice-oriented courses in parenteral products or in pharmaceutical technology.(4,5) Also, courses such as drug literature evaluation, poison control, toxicology and special problems courses in institutional practice are very beneficial in raising the competency levels of the graduating pharmacists. It is not my intent to discuss the entire curriculum today, however; rather, I plan to discuss some of the key areas of the curriculum which impact most directly on the preparation of pharmacists for an institutional practice career.

## HOSPITAL PHARMACY COURSES

When considering institutional pharmacy education, one usually thinks first of hospital practice courses which have been listed in most college catalogs since the 1950s. The courses may have titles such as "Hospital Pharmacy Administration", "Administrative Principles", or "Institutional Pharmacy". They are usually one- or two-semester elective courses. Their contents cover:

> Hospitals—their history, organization, classification, standard of care, accreditation, responsibilities, financing, and deaprtments;
>
> The medical staff—its organization and committees; the formulary system, and the P&T committee;
>
> The ASHP—its statements, guidelines, and residency programs; and
>
> The pharmacy department—its systems and programs, and many related topics.

Some of these courses also emphasize long-term care facilities in small hospitals. Courses may be conducted via lecture, discussion, or special project formats. Field trips to hospitals also have been incorporated. In general, the courses may emphasize the role of the institutional pharmacist, the management of institutional pharmacy departments, or the principles and philosophy of institutional practice. Some colleges offer the management aspect in a separate course, but most colleges offer a single course combining all three areas. Such coursework is valuable in creating an awareness of terminology, literature sources and the role of pharmacy and pharmacists in institutions. Prior to the development of clerkship and externship courses, these electives served as the only means for a student to determine whether he or she might be interested in an institutional practice career. While I could not find any data to indicate how many students actually elect such courses, I would suspect the percentage is rather small. Some schools may not even teach these courses regularly, due to lack of interest.

## PHARMACY ADMINISTRATION

At the end of the 1960s, a tremendous growth in institutional practice was projected. Probably in response to this growth, and recognizing the inadequate preparation of students, Smith(6) suggested that pharmacy administration faculty revise current courses or add new courses to emphasize the managerial, legal, and behavioral science educational needs for institutional practice, emphasizing that clinical coursework alone will not lead to a socially-prepared institutional practitioner. It even has been suggested that pharmacy administration teach much of the material usually covered in the hospital pharmacy practice courses mentioned above.(7) Practitioners in the field have encouraged that time be made available for the student to elect a course of study in administration to prepare for a career as a manager of institutional pharmacy.(8) Learning to manage specialized pharmacy practitioners and technicians and to deal with collective bargaining were among the objectives for this educational program. At least, a residency specializing in hospital pharmacy administration and possibly an advanced degree were considered necessary career qualifications. While pharmacy administration has become more deeply involved in the research needs of institutional practice, there has been very little, if any, significant change in such course offerings to the extent that a model program has developed.

## CLERKSHIPS AND EXTERNSHIPS

The revision of pharmacy school curricula to produce a clinically-oriented graduate in itself has been most beneficial in improving the students' preparation for institutional practice. The sophistication of institutional practice had grown such that the possession of clinical knowledge and skills was necessary for a continued contribution to quality patient care.

Much of this teaching effort in our institutions occurs through clerkships and externships. While both of these types of courses emphasize the teaching of clinical skills, the basic difference is that an externship emphasizes drug distribution and management functions and is sanctioned by state boards of pharmacy, which may allow partial credit toward internship requirements. Sometimes, the terminology is confused both in college course descriptions and in published literature. Clerkships have been described as a hospital or institutional experience program placing considerable emphasis on drug distribution. Likewise, externships have been described as having a complete clinical orientation. Additionally, applying the word "institution" to many clinical clerkships often has led students to believe that such experiences represent the universe of institutional practice, functions, and responsibilities.

Most clerkships emphasize drugs and disease states and, therefore, are of only indirect value in educating students on the broader concerns of institutional practice (9-11). Certainly, learning how to interact with physicians, nurses, and other health care personnel is a valuable outcome which at one time was learned most often in residency programs. Similarly, patient conferences, chart workups, physician rounds, drug information requests, adverse drug reaction screening, and similar activities are also valuable preparations.

Some colleges have described clinical clerkship prerequisite courses which include lectures about the hospital, institutional pharmacy practice, the patient care unit, and related care topics.(12) One only can assume that such offerings provide additional orientation to institutional practice.

Externship courses are required in most undergraduate curricula today. Commonly, the externships provide rotations among community pharmacies, hospital pharmacies, and other practice sites. The time and credit requirements vary from school to school. The University of Utah (13) offers a required five-week institutional practice externship totaling 100 contact hours and an elective five-week institutional practice special problems course. The required externship emphasizes ownership and management of the institution, policies and procedures, supportive personnel, pharmacy organizational structure, the unit dose drug distribution system, the handling of medication orders, patient medication records, procurement and inventory, state and federal laws, and bulk compounding.

At the University of Kentucky College of Pharmacy, the pharmacy practice externship requires 640 hours in one semester. Usually, the student is assigned at least 160 hours (4 weeks) in a hospital pharmacy. During this rotation, emphasis is placed on experiences which assure the development of minimum proficiency in those aspects of pharmacy that are common to all hospitals. Heavily emphasized are medication order handling, types of drug distribution systems, dispensing procedures, inspection of medication on nursing units, after-hours dispensing, and the regulation and handling of controlled drugs. Hospital organization, the formulary system, the pharmacy and therapeutics committee, and institutional accreditation are among the other topics included.

These structured externship experiences in hospitals provide a realistic view of some institutional activities. It would appear that this practical experience can create a lasting awareness of some of the fundamental systems and activities of hospitals. Undoubtedly, this is a dramatic improvement over the educational process of 15 years ago, when students usually learned of these activities through lectures and discussions and had little opportunity, except through an occasional field trip, to see, feel, and touch what they were learning. Today, the frequency of required externship courses exposes more students to some of these basic functions and activities than did the elective approach; however, depending upon the qualifications of the faculty member, the lecture or discussion courses have offered more opportunity to cover the whole of institutional practice principles and philosophy.

Are we doing a better job of educating students for institutional practice today? It is difficult to say. Certainly, the total curriculum prepares a better undifferentiated pharmacist. Evaluative data concerning college curricula are scarce; however, one questionnaire evaluation of practitioners following graduation from the University of Mississippi attempted to determine how well the clinically oriented externship had prepared those currently in institutional practice.(14) The pharmacists rated the experiences as fair.

It also should be recognized that the complexities of institutional practice and the wide range of expertise required today demand a higher level of competence than that attained in colleges of pharmacy. There is considerable evidence to support this conclusion: Surveys indicate that hospital pharmacists spend more time and money on continuing education than do community practitioners and that it is more helpful to their practice.(15) These results are supported by the recognized success of the educational programs of the American Society of Hospital Pharmacists, most notably through its Midyear Clinical Meeting, devoted only to continuing education, which now attracts more than 6,000 people. Numerous reports have appeared describing institutionally-conducted staff development programs to prepare pharmacists to assume clinical practice positions.(16-18) Such programs recognize that academic credentials alone do not assure appropriate skills. Many of our hospitals are developing programs to certify and maintain employees' competence in various practice activities. Residency training programs for institutional practice continue to grow in number and importance. The ASHP has had standards for internships and later residencies since 1948. Formal accreditation began in 1963; today, the 117 accredited programs are a recognized and accepted source of qualified institutional pharmacy manpower.

## THE FUTURE

Because the provision of health care has become increasingly organized in the recent past, the practice of pharmacy in an organized and highly complex system of health care delivery includes an increasing number of specialized functions. There is a greater need for differentiated manpower. The proliferation of pharmacy technician training programs, the development of the doctor of pharmacy degree program, and the creation of special interest groups within the ASHP membership structure are some of the manifestations of the overall response of pharmacy to this need. The ASHP believes that residency training programs have proven to be the best source of highly-qualified hospital pharmacy manpower and that specialized manpower needs within the profession can be met in a large part by residency training programs tailored to those needs. Recognizing this, the ASHP board of directors has taken several positions for planning purposes:

First, in addition to non-professional personnel, the ASHP recognizes the need for the following manpower categories in institutional practice:

generalists;
clinical practitioners;
specialized practitioners; and
managers and administrators.

It is thought that, as time goes on, the distinction between generalist and clinical practitioner will diminish; for the time being, however, that distinction may be appropriate.

Second, residency training is one important component of the educational process in meeting the need for professional pharmacy manpower, including the training of those who function in differentiated and specialized roles.

Third, the ASHP believes that the profession should establish the doctor of pharmacy degree as the standard entry level degree. Further, the Society believes that accredited residency programs should be committed to the goal of establishing a Pharm.D. degree as the commonly-accepted entry level degree for residency training. This position does not overlook, however, the value of accrued professional experience, and the ASHP supports the assessment of any pharmacist's application for residency training in terms of practical experience and self-directed continuing education. Further, the ASHP believes that residency training should occur subsequent to, rather than concurrent with, entry level degree programs.

Fourth, as the nature of academic pharmacy clerkships changes, the needs for residency training will change. The ASHP and residency directors must remain well-informed about changes which occur in the professional practice component of pharmacy school curricula. Residency training always should build on, rather than simply duplicate, clerkship training programs.

With respect to developing specialties, the ASHP will seek advice of our special interest groups on the training standards for specialized areas and will continue to support the directions which have been outlined by the APhA Board of Pharmaceutical Specialties. The ASHP does not believe, though, that specialty recognition has to occur before residency training programs are established. Indeed, specialty residency programs may go a long way toward generating the body of specialists required for specialty recognition.

In accordance with these positions, the ASHP recently revised its Statement on Accreditation of Pharmacy Residencies.(19) The revised statement also makes possible the application for accreditation by other health care facilities and institutions in addition to hospitals. In addition, the following three documents have been approved:

> ASHP Accreditation Standard for Residency Training in Clinical Pharmacy.(20) This document sets standards for a 2,000 hour (minimum) residency in clinical pharmacy and provides for core experiences in medicine, surgery, and ambulatory care, as well as elective training in other areas.
>
> ASHP Accreditation Standards for Specialized Pharmacy Residency Training.(21) This is an umbrella standard for residency training in clinical specialty areas covering structure and process requirements for such residencies. Supplemental standards and learning objectives must be developed for each specialty area.
>
> Supplemental Standard and Learning Objectives for Psychiatric Pharmacy Residency Training.(22) This document, together with the accreditation standards for specialized pharmacy residency training, provides the basis for accreditation of pharmacy residency training programs in this specialized area of practice. The supplemental standards and the learning objectives were developed by the ASHP special interest group on psychopharmacy practice.

Several other special interest groups are working on the development of standards of practice and proposed accreditation standards in their respective areas.

Because of the clinical curricula, today's graduates are better prepared to pursue careers in institutional practice. We cannot expect, or even finance, curricula to be all things to all people and assure competency for every practice role. However, we must expect a sophisticated, common knowledge base in drugs, disease, therapeutics, and the principles of practice. Postgraduate residency programs will prepare the differentiated practitioner. The interdependence of these efforts requires the cooperation of practice and education—for success will depend on the vision of our collective efforts.

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# TRAINING PHARMACISTS FOR PRIMARY CARE IN SWEDEN

By **Hans H. Lindén, M.Sc. in Pharmacy,** Director,
Apotekarsocieteten (The Swedish Academy of Pharmaceutical Sciences), Stockholm, Sweden

I would like to thank the organizers of this congress for inviting me to participate. I am most honored.

My intention is to present the formal programs for pharmacy training in my country, Sweden, and the health care delivery system, our pharmacy system, changes in pharmacy work, and some trends for the future.

Sweden is one of the Scandinavian countries, which form the North of Europe. It has a population of about 8.3 million (1978), and the per capita income in 1978 was 47,620 Swedish Crowns, which then corresponded to about 9,000 U.S. dollars.

## FORMAL PHARMACEUTICAL TRAINING

Formal pharmaceutical training in Sweden is provided by the Faculty of Pharmacy at the University of Uppsala. There are training programs for three academic levels (figure I): dispenser (or, maybe more accurately, prescriptionist)—in Swedish, "receptarier"; pharmacist—"apotekare"; and Ph.D. in pharmacy—in Swedish, "farmacie doktor". The dispenser curriculum covers a period of two and one-half years, the curriculum for a pharmacist's degree four years, and the studies for a Pharm.D. normally require an additional four- to five-year period after the pharmacist's degree.

An intake of 40 students twice per year is permitted for both the dispenser and pharmacist courses. The number of students taking their Pharm.D. degree has varied over the years; about 10 students took their doctor's degree in both 1978 and 1979. Graduation from upper secondary school or the corresponding level of school merit is required for admission to the Faculty. There are, on the one hand, general eligibility requirements which must be fulfilled and, on the other hand, special requirements. The special requirements refer to the subjects of mathematics, physics, chemistry, and biology.

The studies for dispenser and pharmacist levels follow fixed curricula. The curriculum for pharmacists consists of courses listed in figure 2. The first three semesters are devoted to studies in chemistry, as follows: inorganic and physical pharmaceutical chemistry, 19 points (one point corresponds to one week of studies; twenty points thus correspond to one semester, or term, or five months of studies); analytical pharmaceutical chemistry, 16 points; organic pharmaceutical chemistry, 17 points; and pharmaceutical biochemistry, 8 points; for a total of 60 points.

The fourth semester comprises courses in: pharmacognosy, 8 points; morphology, 4 points; and pharmaceutical microbiology, 8 points; for a total of 20 points. The fifth semester's subjects are: physiology, 8 points; pharmaceutical pharmacology, 9 points; and toxicology, 3 points; for a total of 20 points.

During the sixth semester, one traditional pharmaceutical subject and one modern subject are given: Galenical pharmacy (pharmaceutical technology), 13 points; and biopharmacy (biopharmaceutics), 7 points; for a total of 20 points. (Biopharmacy was inserted into the curriculum as recently as three years ago—May 26, 1977—after many years of discussion.)

The seventh semester covers studies on social pharmacy, for a total of 20 points. For the eighth semester, the student may choose either specialized studies (20 points) or specialized studies (10 points) and pathology (10 points), for a total of 20 points.

The total is 160 points, which corresponds—as already mentioned—to a four-year program of studies.

The term "Galenical pharmacy" may be unknown and perhaps should be commented on. This subject deals with the technical design, production and quality control of prepared drugs. "Biopharmacy" deals with the uptake and metabolism of drugs in the living organism and the factors that influence these processes, i.e., what sometimes also would be defined as pharmacokinetics.

Social pharmacy in Sweden deals with the interplay between pharmaceutical activities and society. The course of social pharmacy includes instruction in statutory regulations, civics, economics, administration, and communication theory and practice. It also includes four weeks of practical work at a pharmacy and a course on statistics. The very short period of practical work allowed by the program has led to increased demands for a practical introductory period for pharmacists employed at pharmacies.

This introductory period now consists of six months of in-house training carried out at different types of pharmacies according to a rotating system. The aim is to present and discuss in detail the roles of the pharmacy system and to introduce and practice pharmacy work as well as to comment on responsibilities and work supervision problems. Naturally, the routines for handling drugs and other products, filling prescriptions, information policies and policies for OTC-sales, etcetera, also are covered.

You may have noticed that today there is no possibility of choosing different lines for the pharmacist degree on the grounds of interest or future choice of career, except for the alternatives allowed in the eighth semester. I say "today", because until three years ago the curriculum permitted students a choice between a program of "ordinary" pharmaceutical subjects for the last three semesters and a program with, one might say, a medical touch. The latter program was not popular among either the students or the employers, and, as a consequence, it was terminated.

When considering a pharmaceutical career, there is also the possibility of choosing the dispenser program (figure 3). Training for this program begins with a trainee period at a pharmacy, taking from one to one and one-half years. If this period is concluded satisfactorily, it is followed by one and one-half years of studies at the Faculty.

Thus, the theoretical studies begin with the third semester. The program then consists of courses in: chemistry and pharmaceutical chemistry, 17 points; and pharmacognosy, 3 points; for a total of 20 points. The fourth semester follows, with: pharmaceutical biochemistry, 6 points; chemistry of drugs, 4 points; and pharmaceutical pharmacology, 10 points; for a total of 20 points. During the last (fifth) semester, subjects taught are: pharmaceutical microbiology, 4 points; Galenical pharmacy, 8 points; specialist literature, 1 point; and social pharmacy, 7 points; for a total of 20 points.

The total is 100 points, which correspond to two and one-half years of studies. As in the curriculum for the pharmacist degree, one point corresponds to one week of studies. In the dispenser program, there is a rather long period of practical training, and no introductory program is needed for employment.

Before describing our health care system, I would like to make a few comments on the Ph.D. program. The basis for this program is normally a pharmacist degree. The first one and one-half years of the program consist of attending lectures and instruction in courses relevant to the chosen subject. The second part, of about three years duration, is devoted to scientific work and should lead to the writing of a thesis, which must be presented publicly as a dissertation.

The **dispenser diploma** qualifies the holder for customer service and supervisory work in the pharmacy system. Dispensers also may hold assistantships in the pharmaceutical industry and in quality control and research laboratories.

The **pharmacist degree** qualifies for supervisory posts in the pharmacy system, in the pharmaceutical industry, and in private and public administration. Due to his or her specialized studies, a pharmacist has a certain insight into scientific methodology, which is of particular value in development and research work.

The **Ph.D. degree** qualifies for scientific work in the entire pharmaceutical sphere.

## THE HEALTH CARE DELIVERY SYSTEM

In Sweden, health care delivery is regarded as being clearly a task for the public sector. Private health care, therefore, exists nowadays only on a limited scale. In fact, only about 5 percent of physicians are in private practice (the corresponding figure for dentists, however, is more than 50 percent), and they take care of about 15 percent (1979) of patient visits.

Responsibility for individually-oriented health services and for medical care, both outpatient and inpatient, rests with 23 county councils and three large municipalities which are not part of county council areas (the towns of Gothenburg and Malmo and the island of Gotland). The population coverage ranges from about 60,000 to 1.5 million, with an average of 300,000. The county councils operate their health care delivery systems independently; however, there is supervision by governmental authority primarily through the Ministry of Health and Social Affairs and the National Board of Health and Welfare.

## PRIMARY CARE

Medical care has been and still is very hospital-oriented. The number of beds is about 17 per 1,000 inhabitants, which is a relatively high proportion; however, outpatient care is growing in importance, more or less as a consequence of the rising costs. Primary medical care is organized into primary care districts (figure 4), whose task is to assume primary care responsibility for the health of the population in their respective areas. Each district has one or more nursing homes, for long-term care, and health centers. At the health centers, district physicians, both general practitioners and specialists, provide advisory services, medical attention and preventive care. The system also includes district nurses and district midwives. Moreover, there are special centers which provide child health and maternity health care services, and there are also programs for school health and industrial health services.

When put into full action, the primary care system is expected to satisfy from 80 to 90 percent of the requirements for medical service. Occasionally, when primary care resources are insufficient for the measures required for a certain diagnosis or treatment, responsibility may be transferred to the county-operated or regional hospitals.

## THE PHARMACY SYSTEM

In 1971, a new organizational form for the Swedish pharmacies was constructed. The National Corporation of Pharmacies (Apoteksbolaget AB) was created and since then has been responsible for all retail distribution of drugs to the final consumer. The Apoteksbolaget also runs practically all hospital pharmacies; these number about 100, of which 50 or more also sell to the general public. Altogether, there are more than 700 pharmacies in the country.

Decisions concerning the location of new pharmacies are made in close cooperation with the authorities. The present policy is that new pharmacies for outpatient service, as nearly as possible, should be located in health centers or connected to hospital pharmacies. Today, 20 percent of the pharmacies are already located in health centers, and in 1984 this figure is expected to be 40 percent. Many of these will be small units and will furnish good opportunities for close cooperation with different professional groups. Of overall sales, 84 percent relate to outpatient pharmacies and 16 percent to hospital pharmacies.

There are three categories of personnel in the Swedish pharmacies (figure 5). Pharmacists and dispensers constitute 9 percent and 30 percent of the total number, respectively, and the third category, the pharmacy technicians, constitutes 61 percent (1979). These figures indicate that the dispenser's role is of vast importance for pharmacy operations.

## CHANGES IN PHARMACY WORK

As in some other countries, pharmacy work in Sweden has changed over the years. The most striking trend is the change from the manual preparation of medicines to the distribution of pharmaceutical specialties manufactured by the drug companies. At the same time, there is an increasing customer demand for satisfactory information on the drugs supplied. Almost 90 percent of the value of outpatient sales relates to pharmaceuticals.

The change in the trend of the work is leading to a diminishing need for expert knowledge of drug preparation and technical assistance, in favor of a good knowledge of biomedical sciences and a proper understanding of customer relations. The process of "technical assistance" is gaining from the introduction of technical aids, such as EDP, and reorganizing the work according to specific routines, and so on.

## A NEW TRAINING PROGRAM

These factors, in combination with a report of improvements to be introduced into the curriculum for pharmacy technicians, led to an in-company committee set up by the Apoteksbolaget two years ago, which was given the task of presenting a training program common to both dispensers and pharmacy technicians. Thus, in the future there is expected to be only one category of personnel at the basic level. The pharmacist degree will be the next level.

The report of the in-company committee was published a year ago, and it proposes a two-year program (figure 6), of which the first one-half year (20 points) comprises practical training in pharmacy. The following year is to be devoted to theoretical studies (20 + 20 points) at the Faculty of Pharmacy, and almost the last one-half year (15 points) will consist of studies on applied pharmacology carried out at special pharmacies under the auspices of the faculty.

This report is now being discussed, and, I can assure you, many aspects already have been brought up to be penetrated.

## POST-GRADUATE TRAINING

If the proposed program or any changes that might come out of the discussions are put into action, there will be a tremendous need for supplementary training for those pharmacy technicians who wish to acquire the new qualification. This hardly can be achieved without the introduction of special programs, which must be made available at a large number of places throughout the country.

The time at my disposal today does not allow me to go further and also discuss post-graduate programs in detail. The Ph.D. program has been mentioned, but there are also programs offered by both the Apoteksbolaget and Apotekarsocieteten. Apotekarsocieteten was formerly the Society of Pharmacy Proprietors, but today it functions as a pharmaceutical academy. Its task is to work for the development of pharmaceutical sciences in Sweden and for a high professional pharmaceutical standard.

## CONCLUDING REMARKS

When discussing educational profiles, the key questions today are, as always: What are the demands that society will make of its professional practitioners? What kind of service are we expected to deliver, and what kind of contributions do our educational backgrounds qualify us for in primary care? And, as a consequence, what kinds of changes are needed for the future?

In Sweden, there has been a gradually increasing expansion of the biological and medical sciences during the last 15 years. Many believe that such a direction is the only way forward and would like to speed up the process. However, there is a delicate problem left to be solved: How to satisfy, on the one hand, the demands for proficiency and knowledge in the areas important for drug research and development, and on the other hand the needs for the clinical experience which is of fundamental importance for a deeper involvement in patient counseling?

I thank you for your attention.

Figure I

PHARMACEUTICAL DEGREES IN SWEDEN

| | |
|---|---|
| Dispenser ("receptarier") | 2.5 years |
| Pharmacist ("apotekare") | 4 years |
| Ph.D. in Pharmaceutical Sciences ("farmacie doktor") | pharmacist degree plus 4 to 5 years |

For dispensers and pharmacists, the intakes are 40 students twice a year, respectively.

## Figure 2

### PHARMACIST DEGREE (4 YEARS)

| | Points[1] | |
|---|---|---|
| Semesters (terms) 1, 2 and 3 | | |
| Inorganic and physical pharmaceutical chemistry | 19 | |
| Analytical pharmaceutical chemistry | 16 | |
| Organic pharmaceutical chemistry | 17 | |
| Pharmaceutical biochemistry | 8 | 60 |
| Semester (term) 4 | | |
| Pharmacognosy | 8 | |
| Morphology | 4 | |
| Pharmaceutical microbiology | 8 | 20 |
| Semester (term) 5 | | |
| Physiology | 8 | |
| Pharmaceutical pharmacology | 9 | |
| Toxicology | 3 | 20 |
| Semester (term) 6 | | |
| Galenical pharmacy | 13 | |
| Biopharmacy | 7 | 20 |
| Semester (term) 7 | | |
| Social pharmacy | | 20 |
| Semester (term) 8 | | |
| Specialized studies | 20 | |
| or | | |
| Specialized studies | 10 | |
| and | | |
| Pathology | 10 | 20 |
| TOTAL | | 160 |

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[1] One point corresponds to one week of studies and 20 points to one semester (term).

Figure 3

## DISPENSER LINE (2.5 YEARS)

| | Points | |
|---|---|---|
| Semesters 1 and 2 | | |
| Supervised practical training at a pharmacy | | 40 |
| Semester 3 | | |
| Chemistry and pharmaceutical chemistry | 17 | |
| Pharmacology | 3 | 20 |
| Semester 4 | | |
| Pharmaceutical biochemistry | 6 | |
| Chemistry of drugs | 4 | |
| Pharmaceutical pharmacology | 10 | 20 |
| Semester 5 | | |
| Pharmaceutical microbiology | 4 | |
| Galenical pharmacy | 8 | |
| Specialist literature | 1 | |
| Social pharmacy | 7 | 20 |
| TOTAL | | 100 |

Figure 4

## PRIMARY MEDICAL CARE IS ORGANIZED INTO PRIMARY CARE DISTRICTS

Nursing homes for long-term care
Health centers
District physicians
District nurses
District midwives
Child health programs
Maternity health care services
School health services
Industrial health services
Private health care

## Figure 5

### PHARMACY PERSONNEL CATEGORIES (1979)

| | |
|---|---|
| Pharmacists | 9 % |
| Dispensers | 30 % |
| Pharmacy technicians | 61 % |

## Figure 6

### NEW TRAINING PROGRAM
### COMMON TO BOTH DISPENSERS AND PHARMACY TECHNICIANS

| | Points | |
|---|---|---|
| Semester 1 | | |
| Pharmacy training | 15 | |
| Social pharmacy | 5 | 20 |
| Semesters 2 and 3 | | |
| Pharmaceutical chemistry | 11 | |
| Biochemistry | 4 | |
| Pharmaceutical pharmacology | 15 | |
| Microbiology | 3 | |
| Galenical pharmacy | 5 | |
| Social pharmacy | 2 | 40 |
| Semester 4 | | |
| Applied pharmacology | 15 | |
| Social pharmacy | 5 | 20 |
| TOTAL | | 80 |

[1] Including anatomy, physiology, pathology, and chemistry of drugs.

# EDUCATION FOR THE PHARMACEUTICAL INDUSTRY — SOME ALTERNATIVES

By **Keith Marshall, Ph.D.**, Director, Institute for Applied Pharmaceutical Sciences, East Brunswick, New Jersey, U.S.A.

One of the great paradoxes in pharmaceutical education is that while in recent years we have witnessed an increasing emphasis on optimizing dosage form design and manufacture, there seems to have been a parallel decline in the amount of undergraduate time devoted to the pragmatic implications for the industrial pharmacist. For instance, a survey of the most recent prospectuses of some 50 colleges of pharmacy in the United States revealed that less than 10 percent have industrial pharmacy, pharmaceutical technology, or manufacturing pharmacy as a required course. Most, if they mention it at all, have relegated it to "elective" status, and many now associate it only with the graduate program.

I could find only one school that actually had a "professor of industrial pharmacy" listed as such. Now, while I am sure many more have staff who teach the subject—under an alias, why not demonstrate to industry a commitment to this area of technology?

A further possible indication of this undesirable trend is the apparent lack of interest in publishing technical articles, as evidenced, for example, by the steady decline in the percentage of papers in the Industrial Pharmaceutical Technology section of the annual Academy of Pharmaceutical Sciences meeting (Figure 1), while the Basic Pharmaceutics contributions have experienced healthy growth—although not at expense of IPT, to judge from titles.

Dr. Smith has highlighted a contemporary dilemma in the pharmaceutical industry, namely, its inability to recruit the number and type of post-doctoral professionals it needs—a situation that is unlikely to be resolved in the short term. Not surprisingly, therefore, manpower development executives already are resorting to appointing more staff at the baccalaureate level. This in turn creates a need for in-post training programs to try to convert these young people rapidly into individually useful members of the industrial team. It seems likely that the proliferation of undergraduate externship programs will encourage more students to seek careers in industry, swelling even more the numbers requiring this training. Generally speaking, however, the companies themselves are poorly equipped to develop the necessary programs in-house, and, sadly, most colleges of pharmacy have totally neglected this aspect of continuing education for the recently graduated pharmacist in industry.

The hypothesis I would like to present centers upon provision of a comprehensive curriculum of non-degree oriented studies as an addition—not an alternative—to the traditional graduate programs reviewed by Dr. Smith.

Let us first enumerate possible ways in which the special educational needs of this "new employee" group could be met. Conspicuous by their absence are company training sessions, because, as I have said, most firms do not, at the moment, possess the resources for them. If we don't help them, though, they may have to acquire them; in fact, already we are seeing an increase in requests for "in-plant" offerings of some of our own programs.

Also deliberately omitted is reference to traditional graduate programs, not only because they were dealt with comprehensively by our first speaker this morning, but also because they do not meet the needs of the group with which I am concerned—for reasons which I feel are pertinent to share with you.

Firstly, the employer is going to "pay the bill" and therefore is in a strong position to call the shots; the continuing education exercise must be convenient for the employer—both in timing and in venue. The same is true (to a lesser extent) so far as the employee is concerned. It would appear that many graduate programs are steeped in tradition and do not have the flexibility to accommodate this buyer. In a few cases, even the will to do so is missing.

In a similar manner, but more important still, the program must be clearly seen to provide current, highly pragmatic, and specific information directly relatable by participants to their daily work situation—they come for nuts and bolts, not to collect 80 credit hours and a diploma. The course content must be what is needed by the attendees—not the particular research areas with which the available instructors feel most comfortable.

If you accept these premises, then what are the remaining alternatives?

1. Short courses of a few days duration;
2. programs associated with professional meetings;
3. one-day/evening per week classes; and
4. self-study programs.

The main advantages of the first three are the direct contact they provide with the faculty so that queries can be answered as they arise, and the opportunity they afford for students to interact with one another. Conversely, these are probably the main drawbacks to self-study programs, where the student works in isolation.

In addition, short courses and meeting-associated programs (items 1 and 2) facilitate rapid training in a particular technology within the space of a few days. This will be regarded as quite an advantage if the course coincides with a specific company need. A good example of this would be in the regulatory area, where guidance on the detailed interpretation of, say, new directives is being sought as a matter of some urgency. It is also easier to sustain interest if the overall time interval is kept to a minimum, as any who have tried to maintain student numbers over a whole semester on a one evening per week basis will testify—again a drawback of alternatives 3 and 4, which also require the extra dedication associated with any "in your own time" studies by the employee, not to mention parallel sacrifices by the faculty.

Although training budgets may survive in the current economic climate, monies for travel tend to be among the first to suffer; we detect this in a reduction in the average distance our short course participants have come. In this respect, home study programs have an undeniable unique benefit. In addition, the idea of combining a single travel requirement with attendance at a professional meeting is also an attractive proposition, even though in many cases the venues tend to be in exotic locations away from the hub of the industry. Furthermore, the number of meetings is restricted to one or two a year; therefore, a company can get its people trained in only a limited number of topics by this mechanism. By a similar rationale, one can argue that once a week classes tend to be self-limiting to a highly local audience, whose numbers must be large enough to provide a viable group—not always easy.

The slow rate of learning by this means is obviously another negative factor so far as the company is concerned. In contrast, attendance at a short course, of a few days duration, if it is of the intensive nature I envisage, places the greatest demands on the student's mental processes of all these alternatives. At its conclusion, the attendee should feel saturated and unable to absorb any more. The same will be true of courses associated with meetings—could this be an argument for having them after, rather than before, the meeting itself? While one day a week formats are obviously less demanding in this respect, evening sessions presumably do come at the end of a hard day's work, when the learning curve is dipping, which is hardly in the favor of evening sessions. In this particular aspect, the self-pacing capability of the home-study alternative is one of its major attractions and, in addition—as with one session per week formats, there is a ready opportunity for including in the program private study problems or homework. This is a distinct advantage with more mathematical or "numerical" subject matter, and it is for this reason that workshop sessions are a popular and valuable component of many short courses.

Finally, we must take into account the comparative costs to the organizer of the various alternative formats. Leaving aside manpower requirements (since high caliber teachers are necessary to all approaches), it seems likely that, in general, the direct costs for a meeting-associated program will be the least—provided that promotional literature can piggy-back the meeting notices, the faculty travel costs are covered elsewhere, and a meeting room with required audio-visual aids is available at zero or nominal cost. However, if realistic organizational costs by the professional body and/or those of a separate organizing group are added, there may be little to choose between all four alternatives. The principal reasons for this are that all the possibilities involve a faculty in some way or another, all have to be publicized to potential attendees, and all require written course material. In the case of home study programs, dispensing with classroom costs is replaced largely by a need to provide audio-visual material, which is expensive to prepare, distribute, and up-date.

I think, if anything, short course programs may be marginally more expensive, for the same reasons that I believe make them the optimum method of rapidly disseminating current, pragmatic technological information of the type under review here. "Meeting-associated" programs are a close second. Let me take this argument a step further by reviewing the main criteria I see as necessary to achieve the desired goals. Ideally, they are that:

1. the information is presented in a manner designed to maximize retention by the recipient;

2. the information is presented by experts who are also competent teachers;
3. there is an immediate opportunity for clarification of points not fully understood;
4. the maximum amount of flexibility in program content is retained;
5. the learning environment is familiar to the student;
6. the venue is convenient for employer and employee;
7. the information is disseminated over the shortest convenient time span; and
8. opportunity for interaction between students is provided.

Only the short course format satisfies all eight criteria, since the meeting-associated programs usually involve travel away from the concentration of industry, the one day per week courses take too long to complete, and the self-study programs really only satisfy the criteria for taking material to the student and retaining content flexibility potential.

Evidence that this rationale is realistic can be seen in the proliferation of institutions of one sort or another now offering short courses and, for example, the successful workshops and seminars recently run in conjunction with Academy of Pharmaceutical Sciences and Parenteral Drug Association meetings.

To conclude, may I respectfully suggest that if the colleges are looking for ways to attract industrial support for their post-graduate endeavors, then casting their bread on these waters could do no harm. But, I should warn you that commercial groups already have determined this need and have responded to it vigorously with a plethora of short courses which are widely accepted by industry—and remember, all that these organizations ask of industry is that they pay the course fee.

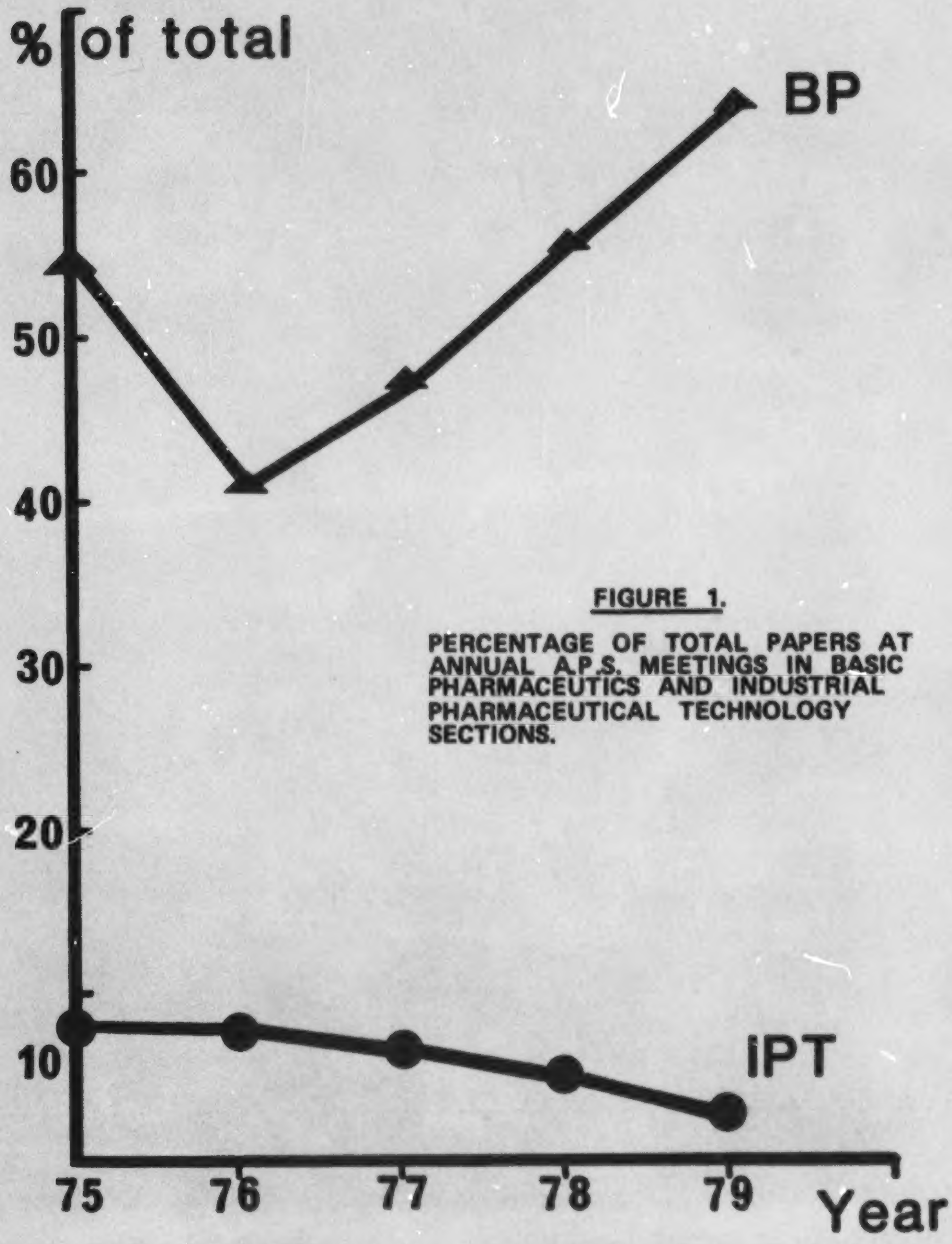

FIGURE 1.

PERCENTAGE OF TOTAL PAPERS AT ANNUAL A.P.S. MEETINGS IN BASIC PHARMACEUTICS AND INDUSTRIAL PHARMACEUTICAL TECHNOLOGY SECTIONS.

# HEALTH SERVICES AND PHARMACEUTICALS: A UNITED STATES PERSPECTIVE

By **Mark Novitch, M.D.**, Acting Deputy Commissioner,
United States Food and Drug Administration, Rockville,
Maryland, U.S.A.

I am honored and delighted to have a chance to participate in this conference.

I have been asked to present a United States perspective on the place of pharmacy in the delivery of health services. That is extremely difficult; there simply isn't a single U.S. perspective on that subject, because different interests have differing views on the role pharmacists can and should play in the American health care system. Furthermore—and I hardly have to point this out—ours is a highly complex and diverse approach to providing health care, organizing it, and paying for it. I don't think there is any reason to believe that this diversity—or pluralism, as it is often called—is about to give way to some unitary mechanism for delivering health services to our 230 million people.

Therefore, if there is a measure of uncertainty about how pharmacy will contribute to health care in the years ahead, that uncertainty is partly the product of a broader range of questions that remain to be answered, questions such as:

How should individuals and the nation pay for health care?

Can we control health care costs without compromising quality and access?

Can we have innovation and technological progress without pricing high quality health services out of the reach of most people?

I do not pose these questions as an excuse for not trying to take a look at the future of pharmacy or at the need for pharmacy education to train men and women to meet the challenges and opportunities they will face in the years ahead. On the contrary, I think it is possible to discern and discuss some trends and forces that will have, and indeed are having, a major effect on the training and work of pharmacists—and that is what I would like to do this morning.

Obviously, these trends and forces are not unique to the United States. Important developments are taking place all over the world, developments which we in the U.S. urgently need to understand—which is what makes an international conference like this one extremely valuable to us, as I am sure it is to our colleagues from abroad.

As a starting point, I would call your attention to the exciting advances in drug development and in the technology of delivering and administering drugs to patients. I only need to mention a few examples to give you a flavor of what I mean:

— bacterial systems that can produce insulin, vaccines, endorphins, and who knows what else;

— large scale production of interferon and other substances that heretofore have been available only in infinitesimal amounts and that hold

enormous promise in the treatment of human disease;
- new forms of drug administration and release that will make current methods, such as intramuscular injection, nearly obsolete; and
- insulin pumps and other systems to administer titratable drugs through tiny implanted devices that respond to changes in body chemistry and are even powered by the body's own biological processes.

Such developments in science and technology—and the list could be extended at length—cannot fail to have a powerful bearing both on what pharmacists need to know and on what they can and will do in providing pharmacy services. Advancing technology cannot fail to present new challenges to pharmacists—not just to those in sophisticated teaching hospitals and medical centers, but also to their colleagues in neighborhood and rural outpatient clinics and in community pharmacies.

And then, consider another, closely parallel, trend: the expansion of clinical pharmacy. Four years ago, many of you participated in the First International Congress on Clinical Pharmacy. It is fair to say that a major goal of that Congress was to define an emerging health care discipline and come to grips with its impact on traditional pharmacy education and practice. Now I notice that the word "clinical" doesn't even appear in the title of this meeting—not because clinical pharmacy is being discounted, but rather because the pharmacist as clinician is now widely accepted as a member of the health care team.

We may not have reached the point at which the term pharmacist implies "clinical pharmacist", but I think there can be no doubt that schools of pharmacy, health care programs, and the public increasingly see the practicing pharmacist as a person who can and should take a larger role in: supervising and monitoring drug therapy; consulting with both physicians and their patients on the selection and use of drugs; evaluating the effects of therapy and the performance of sophisticated drug delivery systems; reporting and analyzing unexpected and adverse drug reactions and interactions; and all other aspects of drug therapy.

Others on the program who are closer to pharmacy education and practice than I am can be more specific about the advance of clinical pharmacy in this country and abroad. I would note, however, that the U.S. Food and Drug Administration is well aware of the need for trained clinical pharmacists to help carry out many of our regulatory responsibilities, from reviewing data on investigational new drugs to evaluating adverse reaction reports and making sure that official drug labeling fully and accurately reflects the information on which FDA approval of a given drug is based. There is also an important role for FDA clinical pharmacists in helping to develop and evaluate drug information intended for patients; I will come back to that subject in a few minutes.

Another factor that is certain to have a major bearing on how pharmacists are trained and how they practice is the rising cost of health care and how we go about meeting it out of both the private and the public purse. While it is true that the cost of drugs and pharmacy services represents only a fraction of health care spending in the United States—something in the neighborhood of 10 percent—we are talking nonetheless about tens of billions of dollars and scores of different systems for covering those costs under public and private third-party payment systems.

Under our system of shared federal and state responsibilities and a mixture of public and private financing of health care, pharmacy services are provided and paid for in accordance with many different requirements. In most jurisdictions, pharmacists are free to make generic substitutions; in some, they are still prohibited by law from making product selections. Some of their patients are entitled to have their drug expenses paid for by federal and state funds, in which case, under the Maximum Allowable Cost program, the pharmacist will be paid an amount equal to the lowest cost at which a multisource drug is generally available, plus a dispensing fee. Private health insurance programs impose still other requirements on coverage of drugs and pharmaceutical services.

From everyone's standpoint—prescribers, pharmacists, consumers, and those who are seeking reasonable and effective ways to control the cost of health services, we in the U.S. have yet to develop the most effective approach to third-party coverage of drugs and pharmacy services.

That poses still other challenges to pharmacists in this country. How, for example, can we use existing technology to reduce and simplify recordkeeping and cost-reimbursement and make them speedier and more efficient? And how can we use that same technology to record vital drug information and permit pharmacists to use that information to prevent possible drug interactions? With that kind of information at hand, the pharmacist is in a position to provide a valuable health care service by counselling the patient, communicating with the physician, and maintaining a vitally important record that probably would exist nowhere else. My point is that a system designed primarily to make drug cost reimbursement manageable and cost-effective could and should lead to better pharmacy services and patient care.

A third trend that is bound to affect pharmacy education and practice, one to which I alluded earlier, involves patient information and education. It seems quite evident that Americans want to know more about the medicines they take; they want to know why a particular legend drug has been prescribed for them, what it is supposed to do, what side effects to look out for, what precautions to take while using the drug, whether a lower cost generic equivalent is available, and many other things. Consumers tell the Food and Drug Administration that they want this kind of information about many commonly used drugs, and, as you know, FDA is committed to finding a good way to meet this legitimate consumer demand.

I don't intend to digress into the patient package insert question; that deserves a forum of its own. I would like, however, to take a minute to look at what the public's desire to be better informed about drugs means for pharmacy education and the work of pharmacists in many different practice settings.

Assuming that drug information intended for patients will become more and more widely available, pharmacists are in a unique position to help patients understand the information that accompanies the drugs they buy and comply with instructions about how to use drugs appropriately. As I mentioned earlier, clinically trained pharmacists are ideally suited to monitor drug therapy. It's easy to visualize this facet of pharmacy practice in a hospital setting, but we also have to think about how it can become a standard part of pharmacy practice in community health centers and other outpatient facilities, and in community pharmacies, as well.

There is considerable discussion in this country about approaches to providing drug information to patients. We have not yet sorted out the most effective roles for physicians, pharmacists, and patient labelling, nor how these information sources can complement one another best. But no matter how that question is resolved, the role of the pharmacist is not going to diminish—it's going to expand. Patients receiving drugs always will want and need advice and information, and they will find it increasingly easier to bring many of their questions to the pharmacist who furnished their medicine and who has ready access to a complete record of the drugs they have used.

I have tried to sketch out briefly the major trends that are sure to have a substantial bearing on pharmacy education and practice in the United States—trends in science and technology, in health care financing and cost containment, and in meeting the need for patient information about drugs and drug therapy. To a greater or lesser degree, I know that these same factors are influencing pharmacy education and practice throughout the world.

While each of the nations represented at this conference will view the role of pharmacy from its own perspective, governed by its own circumstances and traditions, I feel very strongly that we have a great deal to learn from each other. Our shared experience can guide all of us toward more productive use of trained pharmacists, more efficient ways of providing pharmacy services, and, most important, better health care for people in need.

I will conclude by saying that no matter what our individual national perspectives might be, all of us are in a learning process. We simply must look beyond our own boundaries—political and institutional—to seek out the most creative role for the pharmacy profession in the decades ahead. It is gratifying that at this conference we are doing just that.

# CANADIAN PHARMACY AND PRIMARY CARE

By **William A. Parker, Pharm.D., M.B.A.,** Associate Professor and Coordinator, Clinical Pharmacy, Dalhousie University, Halifax, Nova Scotia, Canada

## INTRODUCTION

It is a pleasure for me to bring greetings from Canada and Canadian pharmacy and to discuss briefly primary care education and practice as it is developing in Canada.

By way of introduction, Canada has eight colleges of pharmacy offering a four-year baccalaureate degree and one trade school in Newfoundland offering a three-year diploma (recognized only in that province). Six of the eight colleges are English-speaking. There is one in each of the provinces, with the exception of Quebec, Newfoundland, and the three smaller Maritime provinces. In the latter, Dalhousie University serves as the regional college of pharmacy. Two colleges exist in the province of Quebec, both French-speaking. Presently, moves are underway to elevate Newfoundland's program to a four-year, degree-granting program.

In addition to our programs being only four years in length, an average academic year consists of only about 26 weeks of classtime—short, by American standards. Most provinces require the equivalent of one year's internship or practical experience in addition to the pharmacy degree for licensure, although the time-service requirement often is reduced by counting practical training and clerkship time gained through the formalized university programs. We also have a national licensure exam, the Pharmacy Examining Board of Canada (PEBC), which permits our pharmacists national mobility.

Like many American colleges of pharmacy, we are experiencing a great influx of female students. Most, if not all, of our colleges of pharmacy have about a 50:50 sex ratio; my own college has 75 percent female students. The largest percentage of our incoming students is admitted directly from high school, although some programs require at least one year of university prior to admission, depending upon the status of high school in their particular provinces.

Our colleges graduate approximately 600 pharmacists per year, bringing to total approximately 12,000 practicing pharmacists to serve 23 million people. Some areas of the country have a surplus of pharmacists, while other areas are chronically deficient, owing, in particular, to geographic and language considerations. In my area of the country, the Maritimes, approximately 80 percent of our graduates enter community practice, approximately 15 percent enter hospital practice, and the remaining 5 percent enter graduate school or other careers. Those entering community pharmacy practice find approximately 55 percent of the drug stores to be independently owned and the other 45 percent chain-operated. I believe these figures on career choice and pharmacy composition in our region are fairly compatible with other areas in Canada.

Several formalized pharmacy technician programs exist, but they have developed pretty well in isolation, with little, if any, contact with or input from the colleges of pharmacy. Overall, pharmacy technicians are greatly underutilized in Canada; most pharmacists still carry out the traditional role of dispensing. A possible exception is hospital pharmacy practice, but even here technicians are not used to the same extent as is found in many American hospitals.

Despite the great distances between our colleges of pharmacy and the language issues tending to separate our country, all eight colleges of pharmacy are united under the Association of Faculties of Pharmacy of Canada (AFPC) to work toward a uniform pharmacy education program engendering professional practice.

I now will attempt to highlight briefly the evolution and status of contemporary Canadian pharmacy education and practice with regard to so-called primary care, or what I choose to call "patient-oriented practice". In an attempt to maintain some uniformity for discussion purposes, I will adopt Dr. Herfindal's five broad areas of primary care practice for my discussion: triage; prescribing; consultation; refill authorization; and patient education.

## SIMILARITIES AND DIFFERENCES

Many similarities exist between Canadian and American pharmacy, largely because of the proximity of our two countries and because most of our clinical pharmacy educators have, at one time or another, received their clinical education and training in the United States. For these reasons, an "American approach" to clinical education as highlighted by Dr. Herfindal can be found in most of our colleges; however, differences emanating from the Canadian national hospital insurance system, pharmacy curricula, and post-graduate training programs have brought with them some changes in the direction of Canadian pharmacy as opposed to American practice.

## NATIONAL HOSPITAL INSURANCE

National hospital insurance, which is essentially the responsibility of each individual province, has created a climate that has had a definite impact on hospital practice and in many ways has moved it and its attendant primary care services away from that in the United States.

The introduction of national hospital insurance resulted in such things as hospital beds, diagnostic tests, therapeutic agents such as pharmaceuticals, and nursing care being provided to patients as a benefit for which there was no direct charge. This resulted in pharmacy departments no longer generating revenue, therefore giving them less stature in laying claims for hospital resources. In addition, budgets imposed by health insurance agencies also impeded the growth and development of pharmaceutical services in all but the newer teaching hospitals, as reflected in a lower staffing level than in comparable hospitals in the United States. Another unexpected occurrence was the virtual disappearance of outpatient dispensing from many Canadian hospitals. While this has allowed hospital pharmacists to focus their attention solely on providing in-patient services, it has limited significantly pharmacy's access to and utilization of many ambulatory care clinics. While these factors are slowly changing for the good, they have slowed pharmacy's growth in an important area.

As far as clinical pharmacy educators are concerned, these developments have imposed several hardships on our clinical and primary care developments: a frequent shortage of adequate role model sites and hospital staff (particularly in ambulatory care and chronic disease management, which could be applied more readily to the community setting); undesirable clinical instructor:student ratios on clerkships; student overloading in a select few facilities; and difficulty in linking prescribing, drug distribution, and drug-use control measures with other primary care functions, such as consultation and patient education.

## PRIMARY CARE IN THE HOSPITAL

Overall, national hospital insurance has resulted in a more uniform level of service, with the result that there are very few pharmacy services that are very deficient by today's standards as compared with the United States. On the other hand, there are also relatively few outstanding services. Nonetheless, a large number of our teaching hospitals are providing a wide range of primary care services. Pharmacists in my 450-bed hospital actively participate in ward and chart rounds, regularly present medical grand rounds and inservice programs, operate an in-hospital drug information service, provide clinical pharmacokinetic consultations upon request, and provide a patient medication discharge counseling program. In addition, we have organized specific patient education programs in diabetes, myocardial infarction, and rheumatoid arthritis, and we are in the process of implementing a hospital-wide health education audio-visual series utilizing pre-existing TV sets in the patients' rooms. With the exception of one Pharm.D., we have accomplished our services with baccalaureate pharmacists. Elsewhere, several of our Canadian centres offer home total parenteral nutrition (TPN) programs, and some have introduced recently a home parenteral antibiotic therapy service.

To the best of my knowledge, we have no clinics or medical practices run by "pharmacy-managers" in Canada nor any pharmacists who have been delegated responsibility for direct dosage adjustments through prior authorization and/or flow-chart systems as exist in some parts of the United States.

For a further discussion on Canadian hospital pharmacy, I would refer you to Bachynsky's article "Hospital Pharmacy in Canada" (Am. J. Hosp. Pharm. 37:501-504, 1980).

## PHARMACY CURRICULA

In the past, our four-year pharmacy programs have not been able to provide enough clinical exposure for our graduates; however, recent curriculum revisions, minimal clinical pharmacy education requirements, and post-graduate training programs have allowed improvement in this area.

Most colleges of pharmacy in Canada have undergone or are undergoing significant curriculum revisions, with emphasis on enhancing the clinical component (which first was introduced in Canada in 1969 at the University of Toronto). AFPC presently is working on a minimal acceptable curriculum for all its colleges which recommends that approximately 25 percent of all required instructional time be devoted to professional (clinical) aspects. Some examples proposed include the following areas:

- Therapeutics (125 hr.) (encompasses Herfindal's therapeutics, patient management, and communications)
- Clinical pharmacy (80 hr.) (encompasses Herfindal's communications, patient management, and drug literature evaluations)
- Social and administrative pharmacy (50 hr.) (encompasses Herfindal's health systems management)
- Clerkships (hospital, 80 hr.; community, 80 hr.) (encompasses all of Herfindal's primary care skills/competencies in a practice setting.

I should point out that several of our colleges presently are offering much more clinical instruction than the above proposed minimum requirements. In addition, elective courses providing additional depth are offered in such primary care areas as drug information and drug literature evaluation, applied therapeutics, and pharmacy management.

Our teaching methodologies include mixtures of didactic lectures, case study analysis, role playing and videotaping feedback, and on-site clerkships and tutorials. Although some of our colleges have developed extensive written behavioral objectives and competencies, the majority have not. The innovative evaluation mechanisms discussed by Dr. Herfindal generally have been lacking, as well.

Although our curricula are heading in the right direction for preparing pharmacists to assume primary care responsibilities, our students need a broader exposure to patients and disease types on their clerkships (e.g., pediatric, adult and geriatric patients in acute and chronic stages of management), more clinical and physical assessment skills, a greater opportunity to work with physicians and nurses in the direct provision of medical services, and improved management competencies to afford them the opportunity to implement and maintain their primary care services. These factors are expensive, but, I believe, necessary.

The impact of the above proposals and changes in clinical education will necessitate further cutbacks in the basic and social sciences/electives, expanding our programs to five years, and/or lengthening our academic years into the summer months to accommodate practical training and clerkship programs.

## POST-GRADUATE TRAINING

At the present time, we do not have any Pharm.D. programs in Canada, although AFPC and several constituent colleges are looking into establishing such a program or possibly a "clinical scientist" type of Ph.D. A couple of programs in clinical pharmacy/pharmacology exist at the master's level, and we have a fairly extensive one-year post-baccalaureate pharmacy residency program across the country. Such a lack of sufficiently trained graduate practitioners has compromised, to some extent, the scope and expansion of our undergraduate clinical programs and their primary care services.

Our residency programs initially were conceived and oriented toward hospital pharmacy management and administration; however, the clinical component has increased steadily to the point of occupying the majority of hours spent in many of the programs. Such a strong clinical orientation has helped to fill the gap and has become a big selling point in attracting large numbers of clinically-minded applicants. While good clinical practitioners are evolving from these programs, their numbers are still small compared with those in the United States, and they themselves still are learning and developing, sometimes having less than sufficient clinical expertise to be instructors.

With few exceptions, all residency programs are located in hospitals. This has resulted in the same situation that only now seems to be changing in the United States, namely, that clinical education and, most importantly, its primary care services have become the possession and domain of hospitals rather than of the larger and more needy community environment. By no means has this been bad, though. The Canadian Society of Hospital Pharmacists (CSHP) has accepted this responsibility with enthusiasm and dedication. It has prepared and published practice standards and guidelines in most areas of primary care, such as clinical pharmacy, drug monitoring, and the provision of drug information services. Most recently, it has prepared and approved a statement on the role of the pharmacist in preventive health care, indicating that the profession has maintained a broad view of the health system and the pharmacist's place therein.

## PRIMARY CARE IN THE COMMUNITY

I believe we are making some definite gains in the area of primary care pharmacy in the community. The advent of mandatory courses in communication skills, over-the-counter (OTC) drugs, social and administrative pharmacy, and community-based practical training programs requiring certified community pharmacist-preceptors has been largely responsible for its growth. In addition, such tools as family medication record systems are becoming commonplace, and the use of in-store computers is becoming more and more accepted and adopted.

Using Dr. Herfindal's primary care scheme once again, triage and refill authorization functions have not become a reality yet in Canada and probably won't for some time; but the opportunities exist, particularly in our territorial outreach pharmacies and in our programs with our native people, similar in environment to the United States Indian Health Service.

In the area of refill authorizations, our French colleagues in Quebec are now in the position of receiving dispensing fee reimbursements for refusing to fill or refill a prescription when in their professional judgment such refusal is justified.

Also in the area of consultation, guidelines for pharmacy services in the long-term health care facility have been prepared and adopted, with the effect that many nursing homes now are receiving coordinated, on-going pharmacy services such as drug-use reviews, inservice education programs, and the like. Further to consultation, several provinces have regional drug information centers developed and operated by pharmacists.

More of our community pharmacies also are offering full lines of health accessories, such as ostomy and surgical appliances, and some are providing trained fitters and technicians on-site in their pharmacies. Pharmacists in some provinces, such as Ontario and Quebec, essentially have combined a consultation-prescribing role by having certain over-the-counter medications regulated by controlled access, thus necessitating intervention by the pharmacist.

Lastly, in the area of community patient education, the Canadian Pharmaceutical Association (CPhA) has initiated and supported the development of supplementary information on medications (SIMs) for use by patients, similar to the patient package insert issue in the United States. CPhA also has prepared the Canadian Selfmedication book, similar to the American Handbook of Nonprescription Drugs, which contains patient-questions and information for the pharmacist to use. Also, we presently are conducting a nationally-funded project to evaluate the feasibility, utilization, requirements and cost-benefits of patient drug counseling/education programs in community pharmacy.

## CONCLUSION

I would like to conclude at this point by directing a few comments to our other foreign guests who also find themselves faced with developing primary care pharmacy. As I have shown, we in Canada have many similarities with the United States in our evolution and direction of primary care. I do not feel that this is wrong or undesirable, because much can and has been learned from that country's experience; however, we have had to make certain necessary adjustments, and I feel strongly that in adopting and implementing any borrowed ideas, we must constantly remember to modify them such that they fit our own demands, needs and restraints.

I would like to thank you for your attention and for the opportunity to share a little insight into Canadian pharmacy.

# PREPARING FIRST DEGREE PHARMACISTS FOR INSTITUTIONAL PRACTICE

By **Gerald E. Schumacher, Pharm.D., Ph.D.,** Dean,
College of Pharmacy and Allied Health Professions,
Northeastern University, Boston, Massachusetts, U.S.A.

The "Standards of Practice for the Profession of Pharmacy", developed by the American Pharmaceutical Association and the American Association of Colleges of Pharmacy, represents the most authoritative statement on the competencies, skills, and activities required for generalized pharmacy practice.(1) For advanced education with specialization in hospital pharmacy practice, the "Accreditation Standard for Pharmacy Residency in a Hospital", promulgated by the American Society of Hospital Pharmacists, provides the most comprehensive source for reference.(2)

There is little that I can add to the recommendations offered in these two documents. Therefore, I will focus my comments on new directions in preparing first degree pharmacists for practice that, if successful, should improve the potential for pharmacists to participate more effectively in the mainstream of health care delivery.

The aforementioned "Standards of Practice for the Profession of Pharmacy" represents the culmination of six years of work which involved the assessment of more than 2,000 individuals, including pharmacy practitioners, pharmacy educators, experts in health care delivery and health manpower, and researchers in the field of competency development. A consensus was reached on 69 responsibilities of pharmacy practice; these then were organized into four categories. These four categories are presented below, with a general summary of the responsibilities delineated in each:

I. General Management and Administration of the Pharmacy
(27 responsibilities)
    A. Selects and supervises pharmacists and nonprofessionals for pharmacy staff.
    B. Establishes a pricing structure for pharmaceutical services and products.
    C. Administers budgets and negotiates with vendors.
    D. Develops and maintains a purchasing and inventory system for all drugs and pharmaceutical supplies.
    E. Initiates a formulary system.
    F. In general, establishes and administers pharmacy management, personnel, and fiscal policy.

II. Activities Related to Processing the Prescription
(19 responsibilities)
    A. Verifies prescription for legality and physical and chemical compatibility.
    B. Checks patient record before dispensing prescription.
    C. Measures quantities needed to dispense prescription.

- D. Performs final check of finished prescription.
- E. Dispenses prescription.

III. Patient Care Functions
(18 responsibilities)

- A. Clarifies patient's understanding of dosage.
- B. Integrates drug-related with patient-related information.
- C. Advises patient of potential drug-related conditions.
- D. Refers patient to other health care resources.
- E. Monitors and evaluates therapeutic response of patient.
- F. Reviews and/or seeks additional drug-related information.

IV. Education of Health Care Professionals and Patients
(14 responsibilities)

- A. Organizes, maintains, and provides drug information to other health care professionals.
- B. Organizes and/or participates in "in-pharmacy" education programs for other pharmacists.
- C. Makes recommendations regarding drug therapy to physician or patient.
- D. Develops and maintains system for drug distribution and quality control.

A thorough examination of the 69 responsibilities in the "Standards of Practice" reveals an illuminating critique of the expectations of pharmacy practice today. Yet, comprehensive as this inventory of activities may be, it deals inadequately with areas of knowledge and behavior that pharmacists must possess if they are truly to fulfill their potential as health care practitioners.

Pharmacy students enter practice today more knowledgeable and aware than did those in the past, largely because of increasing emphasis on clinical medicine, behavioral sciences, internship, and externship. They are fully prepared to meet the majority of responsibilities outlined in the standards. Still, they learn little of their role in the broad context of health care delivery, of the skills and knowledge of health care providers other than physicians and nurses, of the self-awareness and confidence of their special competence, and of the attitudes, behaviors, and policies that shape health care policy and, thus, their destiny.

To date, colleges of pharmacy have done little to bring about this needed orientation and sensitivity to the social, attitudinal, political, and interprofessional aspects of health care delivery. This, perhaps, has been the principal failing of our colleges in preparing students for fully rewarding careers in practice.

My views appear to be shared by both the Study Commission on Pharmacy (3) and the National Commission on Allied Health Education (4), which have recommended significant changes in the education of pharmacists and allied health professionals to prepare them for more effective roles in the delivery of health care. While both commissions make copious suggestions for change, some of the recommendations common to both reports focus on improved and expanded education in the humanistic, communicative, and socioeconomic aspects of health care delivery.

Our College of Pharmacy and Allied Health Professions is considering actively an approach to achieving a student mastery in these areas which should be sufficient for first degree practitioners. A sequence of courses to be offered in the first, middle, and terminal years of the curriculum is suggested for providing longitudinal development and reinforcement of topic areas. Four general areas are suggested for inclusion in this sequence of three courses:

I. Interprofessional Awareness. A mutual understanding of the importance of the services provided by various categories of health personnel and the roles and functions of each, including the range and limits of independent action.

II. Patient Awareness. Sensitivity to the behavioral and humanistic needs of the patient.

III. Communication Skills. Skills needed for effective patient and interprofessional counseling.

IV. Health Care System. An understanding of the various economic, political, legislative, and regulatory factors influencing health care systems.

Some suggested topics for these general areas include the following:

A. Health Care Providers and Health Care Delivery
   1. Roles, competencies, and interprofessional relationships
   2. Professional advocacy: The role of professional organizations and professionalism.

B. The Health Care Delivery Process
   1. Health manpower
   2. Health care financing
   3. Federal legislative process and health care
   4. Regulatory process and health care
   5. Provision of health care in ambulatory and institutional environments

C. Behavioral and Humanistic Aspects of Health Care
   1. Characteristics of helping relationships
   2. Problems and understanding of the patient
   3. Sensitivity to special patient situations
   4. Problems and understanding of co-workers
   5. Social and moral issues in health care

D. Communications Within and Among Professions
   1. Verbal and nonverbal communication
   2. Oral and written communication
   3. Patient communication and counseling
   4. Intra- and inter-professional communication

E. Case Studies in Health Care Provision

Enhancing the already well-developed pharmaceutic, therapeutic, and administrative knowledge of pharmacists by adding the behavioral, communicative, and socioeconomic knowledge described above should improve markedly the potential for practitioners to participate effectively in health care delivery.

Of course, the majority of educators interacting with students during progress through the pharmacy curriculum are not fully sensitive to the value of and techniques for incorporating humanistic, communicative, and socioeconomic knowledge within the total learning process. Success, therefore, requires development of faculty workshops to sensitize and prepare faculty to integrate and reinforce elements of these subject areas in the courses that they teach and/or clinical instruction.

Our collegiate structure, which includes pharmacy and various allied health programs in one administrative unit, is part of a trend wherein pharmacy affiliates with other health programs to share administrative and academic resources. Compared with the traditional college of pharmacy, this merger of programs offers many benefits and opportunities, some of which may enhance the chances for success in providing humanistic, communicative, and socioeconomic orientation. Professions included in our College are pharmacy, medical laboratory science, respiratory therapy, physician assistant, toxicology, and health record administration. By presenting this subject material to students in all of the professional programs, students learn throughout their academic preparation of the knowledge, values, strengths, and limitations of various health care practitioners with whom they will interact during their careers. Through direct involvement with students from other health professions, they learn the skills, behaviors, and approaches that each uses to react to, interpret, and make judgments on various situations encountered in providing health care.

The affiliation of pharmacy with various allied health professions appears to offer the potential for a better opportunity and more suitable environment, especially in these critical areas of affective response, for developing professionally more meaningful academic programs, for enhancing interprofessional awareness, and for testing innovative methods of health care delivery.

In conclusion, the "Standards of Practice for the Profession of Pharmacy" suggests in its inventory of 69 responsibilities, albeit indirectly, that mastery of fundamental concepts of humanistic behavior, communication skills, and socioeconomic theory applied to health care are critical to the effective and full expression of pharmacy practice. A more vigorous exposure of students to these subject areas is encouraged if the standards truly are to be achieved.

## References

1. Standards of Practice for the Profession of Pharmacy. American Pharmaceutical Association and American Association of Colleges of Pharmacy, 1979.

2. ASHP Accreditation Standard for Pharmacy Residency in a Hospital. American Society of Hospital Pharmacists, 1979.

3. Pharmacists for the Future; The Report of the Study Commission on Pharmacy (Ann Arbor: Health Administration Press, 1975).

4. The Future of Allied Health Education (San Francisco: Jossey-Bass Publishers, 1980).

## EDUCATION FOR THE PHARMACEUTICAL INDUSTRY

By **Robert V. Smith, Ph.D.,** Director, Drug Dynamics Institute, College of Pharmacy, University of Texas at Austin, Austin, Texas, U.S.A.

The pharmaceutical industry is a vital employer of graduates of colleges and schools of pharmacy. In the United States, this is particularly true for Ph.D.-level graduates who complete their education at a rate of approximately 150 per year through programs administered by 43 of the 72 member schools of the AACP.(1) While I will address all grades of education in U.S. colleges of pharmacy, overwhelming emphasis will be placed upon academic doctoral-level programs because of current needs and the fact that only a small percentage of baccalaureate pharmacy students traditionally have sought employment in the pharmaceutical industry. It is acknowledged, however, that the industrial internship program recently instituted by the National Pharmaceutical Council (NPC) ultimately may help to reverse this situation. Except for hospital pharmacy, master's programs in the pharmaceutical sciences in the U.S. have more or less led to the granting of "orphan degrees" and, therefore, will not be discussed further.

During the development of this presentation, insights and opinions were informally solicited from an about equally proportioned group of 48 industrial managers and academicians; judgments were sought on the needs for doctoral-level persons in industry, the types of educational experience deemed important, and the values placed on education that might be achieved in a pharmacy school versus that attainable in an equivalent counterpart (e.g., chemistry department, medical school pharmacology department). Additionally, information gained through the activities of the APhA academy of Pharmaceutical Sciences Committee for Federal Research Support (2) was helpful in developing the perspectives presented here.

This presentation will address current industrial needs for pharmaceutical scientists in the areas of pharmaceutics, medicinal chemistry and pharmacognosy, pharmacology and toxicology, and pharmacy administration. In all these discussions, the necessity to develop high quality graduates is emphasized. Recognition is given to the fact that federal support to graduates and postdoctoral training is likely to decrease or remain stable (in real dollars) over the next 10 to 20 years. At the same time, academicians in the United States must realize that the proportion of 18- to 24-year-olds is projected to decrease by 23 percent by 1997.(3)

I will conclude by proposing strategies for improving the effectiveness of training graduate-level pharmaceutical scientists. In a recent work, I have described more thoroughly many of the ideas presented here.(4) Finally, I will present suggestions for closer collaboration between academic and industrial institutions.

### CURRENT STATUS OF U.S. PROGRAMS

Colleges and schools of pharmacy in the United States currently are administering Ph.D. programs in pharmaceutics (industrial pharmacy, physical pharmacy, and biopharmaceutics/pharmacokinetics), medicinal chemistry and pharmacognosy, pharmacology and toxicology, and pharmacy administration (socio-economic pharmacy). The more established programs are nearly 30-years old, while others have developed real strengths only in the last 10 to 15 years. In terms of grant funding and publications, about 15-schools accounted for 60-percent of all activity during the period 1978 through 1979.(1)

Only a handful of schools have experimented with B.S. and M.S. programs that have been designed specifically to meet industrial needs. These programs have been principally in the area of toxicology and will be addressed briefly.

## Industrial Pharmacy, Physical Pharmacy and Biopharmaceutics

Programs in industrial pharmacy, physical pharmacy, and biopharmaceutics/pharmacokinetics all can be placed under the umbrella of pharmaceutics; however, in some schools of pharmacy, these areas are lumped under the title "pharmaceutical chemistry" and also may embrace analytical pharmaceutical chemistry as a sub-specialty. Regardless of title, the pharmaceutics Ph.D. is usually concerned with dosage form design, development, evaluation, and performance in biological systems. Programs leading to the academic doctorate generally involve advanced education in mathematics, physical and analytical chemistry, statistics, physical pharmacy, and biopharmaceutics/pharmacokinetics. Many educators acknowledge additional needs for courses in engineering and materials sciences, pharmacology, and industrial management. However, Rhodes (5) warns of potential course "overloads" because of the myriad of offerings that are of potential utility to the industrial pharmaceutics scientist.

A great need exists for Ph.D.-pharmaceutics scientists in industrial firms in the United States. There are also indications that similar needs exist in Western Europe. The most acute shortages appear to be in the area of industrial/physical pharmacy.(5,6) Several reasons can be cited for this state of affairs: First, there has been a general shift in interest of graduate students in recent years toward more biological-type sciences; thus, students who elect a pharmaceutics tract are more likely to pursue specialization in biopharmaceutics or pharmacokinetics. Second, U.S. pharmaceutics faculty have moved more toward biopharmaceutics/pharmacokinetics in the last 10-years. Third, the substantial faculty-equipment-space investment necessary to develop industrial pharmacy programs apparently has been viewed by pharmacy and university central administrations as prohibitive. These problems have been exacerbated by a general lack of federal and industrial support for physical/industrial pharmacy programs and research.(2,7) The federal government generally has not favored supporting physical-industrial pharmaceutical training and research; U.S. industry has been unwilling to invest the $2-5 million per year that has been estimated as being needed to educate sufficient numbers of Ph.D. pharmaceutics scientists.(7)

There are many unmet needs for analytical pharmaceutical chemists in industry. Faculty in this sub-specialty are located in pharmaceutics or medicinal chemistry departments in U.S. colleges of pharmacy and have never represented sufficient numbers to formulate separate departmental or divisional status. Indeed, there are not more than ten faculty nationwide who are clearly identified with the discipline.

The need for pharmaceutics and analytical pharmaceutical chemistry Ph.D.s clearly is not being met by chemistry or engineering faculties. A physical chemist, who might come closest to a pharmaceutics doctorate, will have great deficiencies in his or her background with respect to dosage form design and development. It is acknowledged that two of the "giants" in physical pharmacy, Professors William and Takeru Higuchi, were trained in physical chemistry; however, these two productive scientists and many of their colleagues and students have helped to develop a body of knowledge over the past 30 years that underscores the need for people specifically trained in physical pharmacy.

Analytical chemistry faculty serving in chemistry departments in the U.S. have become increasingly concerned with physical and theoretical chemistry in the last 10 to 15 years. There is certainly a need for this activity to advance the state-of-the-art of analytical chemistry. Doctoral recipients in analytical chemistry, however, have become less exposed to a variety of analytical techniques and approaches that are necessary for analysis of pharmaceuticals. This is particularly true for determinations in complex milieu (e.g., dosage forms, biological fluids). As a consequence, demand for analytical pharmaceutical chemists has increased dramatically in recent years.

It is not my intention to underrate the need for biopharmaceutics/pharmacokinetics Ph.D.s in industry. The demand for these people is not as great as for the more traditional physical/industrial pharmacy doctoral graduates, yet there are still significant opportunities for the Ph.D. in biopharmaceutics/pharmacokinetics. Faculty in biopharmaceutics/pharmacokinetics, however, should be aware of one caveat. As indicated in an earlier paper (8), faculty in the pharmaceutical sciences have no monopoly on their respective areas of research. Indeed, pharmacokinetics has become an area of study for certain pharmacology as well as pharmaceutics faculty. Certainly, the pioneering efforts of Professors Gerhard Levy, Eino Nelson, Sidney Riegelman and John Wagner will not be forgotten; however, as the field of biopharmaceutics/pharmacokinetics advances, faculty will have to become more astute in the biological sciences to tackle the more difficult problems of this field. Indeed, the input of pharmacokinetics faculty could help to make up for deficiencies in clinical pharmacology that exist in many pharmacy-pharmacology programs (see below). At the same time, biopharmaceutics/pharmacokinetics faculty should find it mutually beneficial to form closer associations with pharmacology faculty and/or departments.

## Medicinal Chemistry and Pharmacognosy

The need for doctoral-level medicinal chemists and pharmacognosists in industry has varied considerably over the past 10 to 15 years. This fact has sociological and scientific antecedents. Specifically, medicinal chemistry is viewed by many in industry as principally an extension of organic chemistry; thus, many industrial managers seek out the best organic chemists for openings. Since there has been no lack of organic chemists, even from the best departments, some medicinal chemists coming from pharmacy schools have experienced difficulty in securing employment in industry. Consequently, some new graduates have had to take jobs in allied areas. The tendency to hire organic chemists is often perpetuated by medicinal chemical managers who themselves come out of strictly organic chemical groups.

Partly because of the competition from organic (and bioorganic) chemical groups, some U.S. medicinal chemistry departments have developed excellence within their ranks. This is reflected in part by the relatively high measure of success medicinal chemists have had in attracting extramural grant funds from the federal government. (An analysis of the distribution of NIH grant funds amongst pharmacy faculty for the period 1976-77 clearly supports this conclusion; data available from the author.) On the other hand, a number of mediocre medicinal chemistry programs still exist in the United States, and this has not helped the image and potential employment opportunities for many young medicinal chemists.

This is an appropriate point at which to emphasize a strongly held personal opinion, which is that quality graduates, regardless of their specialization, always will find gainful employment in industry. Thus, the medicinal chemist with an outstanding foundation in organic chemistry, spectroscopy, and pharmacology usually will succeed; however, as with all good doctoral students, exceptional research skills must be developed (see below). Additionally, postdoctoral experience with a well-recognized organic chemist or pharmaceutical scientist may be necessary for the Ph.D. medicinal chemist to create the necessary competitive edge for a position in industry.

There are limited industrial opportunities for traditional pharmacognosy Ph.D.s; however, in recent years, certain pharmacognosy faculty and departments have become more oriented toward organic and bioorganic chemistry. When expertise in these areas is coupled with background and experience in separations methods and microbiology, graduate pharmacognosists result that have expanded industrial opportunities. In this regard, the area of microbial transformations represents an outstanding field for training doctoral candidates who ultimately may find industrial employment in the ever-widening field of antibiotics and antimicrobial research.

The few U.S. medicinal chemistry-pharmacognosy departments that have developed good programs in drug metabolism and pharmaceutical analysis generally find little difficulty in placing their doctoral graduates. Success in these areas will be perpetuated by collaboration with selected pharmaceutics and biochemical pharmacology faculty. So-called drug metabolism specialists will have to develop abilities in pharmacokinetics and pharmacodynamics. People trained in pharmaceutical analysis should have an understanding of the challenges that arise in assay of bulk drugs, drugs in dosage forms, and drugs and metabolites in biological fluids. Thus, background in traditionally defined pharmaceutics areas are appropriate for the pharmaceutical analysis student who is "housed" in a medicinal chemistry department.

## Pharmacology and Toxicology

There are relatively few pharmacology-toxicology graduate programs of high quality in U.S. pharmacy schools. Many U.S. colleges do not have pharmacology departments. Some schools with programs have not invested heavily enough in quality faculty and facilities. First-rate graduate programs will include advanced study in various aspects of pharmacology, including toxicology, physiology, pathology, biochemistry, statistics, and computer science. A number of industrial managers emphasize the importance of the latter two areas because of the great amounts of data that require processing during development of New Drug Applications.

Medical school pharmacology programs have certain advantages over their counterparts in pharmacy schools. Not least of all are lightened teaching loads which permit more time for faculty to develop as effective researchers. Also, as noted earlier, medical school pharmacology programs are able to develop clinical pharmacology sections that are essentially non-existent in pharmacy departments. However, pharmacy-pharmacology programs have the opportunity to enrich their students' programs through collaborative efforts with medicinal chemists and pharmaceutics faculty and students. Such collaborative efforts serve as an outstanding model for the type of cooperation that is required during drug developmental work in industry. Indeed, I have had the occasion to visit with students in a number of medical school pharmacology programs over the past two years. During those encounters, I was struck by the relative naivete of the doctoral students regarding the overall process of drug development. Indeed, the opinion of at least one industrial manager in pharmacology (9) was confirmed; that is, many graduates of doctoral-level pharmacology programs are too narrow in outlook.

Industrial opportunities for Ph.D.-level pharmacologists appear to be excellent at the present time. This is especially true in the subspecialty toxicology, where a need of 200 or more Ph.D.-level toxicologists is predicted for several years to come.(10)

In recent years, at least two U.S. colleges of pharmacy (i.e., Northeastern University College of Pharmacy and Allied Health Professions, and Philadelphia College of Pharmacy and Science) have instituted B.S. programs in toxicology. Information received on one of those programs (10) suggests that an unmet need exists for baccalaureate toxicologists in industry. A third B.S. program in toxicology has been active at St. John's University for 15 years. The director of this program (11) reports that more than 55 students have graduated with a B.S. in toxicology during that period. The St. John's graduates purportedly have been well-received in a variety of companies, including pharmaceutical-type firms.

### Pharmacy Administration

Graduate programs stressing business and socioeconomic aspects of pharmacy are frequently referred to by the unfortunately ambiguous title "pharmacy administration". There are few quality pharmacy administration programs in the U.S.; furthermore, one educator in the area (12) bemoans the fact that the good programs can hardly meet requirements for pharmacy administration faculty, no less fulfill the perceived needs in industry.

Opportunities for pharmacy administration graduates appear to be in the areas of market research, corporate development and planning, research administration, sales management, industrial relations, and public/professional relations.(13) Because of extensive opportunities in these groups in the U.S. pharmaceutical industry, there is little reason to believe that quality pharmacy administration graduates would not be accepted in industrial positions.

## STRATEGIES FOR EFFECTIVELY TRAINING PHARMACEUTICAL SCIENTISTS FOR INDUSTRY

Two elements are of paramount importance in educating pharmaceutical scientists for the pharmaceutical industry. First, there is no substitute for quality.

Pharmacy schools must recruit the best faculty and students, provide them with sufficient basic resources (e.g., equipment, support staff), and allow for sufficient time for faculty to build exceptional programs. There is an element of personal indignation in these admonishments. It is the author's belief that academic pharmacy and significant numbers of pharmacy administrators for too long have considered research and graduate education as dispensable activities. This is deplorable! The pharmaceutical sciences have established themselves well over the past 30 years. Academicians in the pharmaceutical sciences should be proud of this fact! The recent serious shortages of quality pharmaceutical scientists in industry _and_ in academia should attest to the importance of graduate education and research. Pharmaceutical science faculty should emulate medical school faculty and administrations, who view their research roles as essential to the health (_sic_) of society.

The second most important criterion that should be sought in developing and implementing quality graduate programs in the pharmaceutical sciences is an emphasis on research and research skills. Nothing is more important to the industrial manager than hiring creative individuals who are effective problem solvers. This fact has been stated aptly by Dr. Jane Sheridan (14), who proposes that industrial scientists ". . .understand what is meant by defining the dimensions of a project, by controlling their plan when their data is unexpected, by recognizing what are the pertinent parts and what are irrelevant side-tracks and lastly, knowing when the problem is either solved or cannot be solved by currently available resources."

In the sections that follow, the themes of quality and importance of research acumen are stressed.

## Disciplinary vs. Interdisciplinary Training

In graduate education, it is important for the beginning student to work mostly within a discipline. Of even greater significance is the weaving of research and research training _throughout_ the student's graduate career.(4) This notion is illustrated by the diagram labeled A in Figure 1. Note that this model contrasts with a second model, B, which involves two years of intensive coursework prior to beginning research. I favor model A, because it emphasizes research as the "heart" of the student's program; also, it maximizes time allocated to research and problem solving activities.

The major professor has to be more priority-conscious in helping the student choose coursework in the model A system, because there is less time allotted for this activity; however, this liability is worth accepting for the sake of devoting greater overall time to research activities. An additional "hidden" benefit of model A is related to students taking modest amounts of coursework almost entirely throughout their graduate career. That is, students must learn to budget their time, a management-type activity that will be of great benefit to the future industrial scientist.

While I acknowledge the importance of training within a discipline, the student must be aware of interdisciplinary work from the beginning of the graduate career. Especially for the prospective industrial scientist, serious exposure to interdisciplinary work should occur toward the end of the graduate education. This proposal is presented diagrammatically in Figure 2. You also should note that Figure 2 suggests that the postdoctoral fellow receive a heavy dose of interdisciplinary training as a prelude to accepting an industrial position. To clarify what I mean by interdisciplinary research, the following definition is provided.(4)

> Interdisciplinary research involves the joint, coordinated, and continuously integrated efforts of investigators from different disciplinary backgrounds. These people work together to produce results which are so tightly woven that individual contributions are not easily identified. In chemical-biological interdisciplinary studies, for example, the chemist will perform biological experiments; the biologist will do some chemical work. (In contrast) . . .Multidisciplinary research results from experts in different disciplines working separately on various aspects of a primary objective. The synthesis of results is done primarily by the research manager.

I stress the value of interdisciplinary work in graduate and postdoctoral studies because of the unique cross-disciplinary character of drug developmental investigations in industry. Again quoting Dr. Sheridan (14),

> The real value of the pharmacy-trained employee is that they appreciate the end use of our products, they understand the interdisciplinary complexities of our products, and hence can take a broad spectrum approach to the projects they are given to work on.

Interestingly, progressive academicians outside of pharmacy also are beginning to appreciate the value of interdisciplinary efforts. The eminent biochemist Professor Esmond E. Snell, recently wrote the following:(15)

> . . .knowledge, unlike universities, cannot be segmented along departmental lines. . .progress at the frontier of knowledge is most rapid when a variety of investigational techniques is applied. . .Departmental structures, while useful and necessary for administrative and instructional purposes, reflect the historical development of a subject area and cannot anticipate future needs in it. If too rigidly or jealously maintained, they can inhibit the very development they seek to promote. An important function of administration at all levels should be to ensure that rules and regulations do not impede interdisciplinary cooperation in either the teaching or research function of the University. Only the forward-looking actions of individual faculty members can ensure that such cooperation actually occurs.

These persons' arguments must not be misconstrued. Interdisciplinary work does not substitute for a strong disciplinary effort in the better part of the graduate student's academic career. However, a research advisor who promotes interdisciplinary activities is serving his or her students well. One mechanism for accomplishing this objective is to arrange for joint group research meetings with a colleague in a complementary discipline. I have described recently additional ideas for accomplishing interdisciplinary work.(4)

## Management and Communicative Skills

Many industrial managers emphasize the need for managerial and exceptional communicative skills in prospective employees. Courses in management and scientific writing are often available for graduate students; however, the objectives of these offerings should be reinforced by the major professor. Indeed, a good case can be made for improved management skills in professorial research managers.(4) The effective research manager, in turn, serves as an outstanding model for the student. More specific mechanisms that aid the graduate or postdoctoral student include requirements for written monthly reports and oral presentations at group research meetings, regularly planned individual research conferences between student and professorial advisor, and mandatory participation in organized journal clubs and departmental or collegiate seminars.(4) Communicative skills are further enhanced by encouraging presentation at regional and national meetings of scientific organizations and by planned joint review of manuscripts prepared by members of the research group or submitted to the major professor as referee.(4)

## Improving Academic-Industrial Interactions

Since the pharmaceutical industry will be a prime benefactor of improved graduate programs in the pharmaceutical sciences, it seems sensible that the industry should be willing to be of tangible assistance. At this point, it is important to note that few departments or universities have the resources to finanance fully high-quality graduate and research programs in the pharmaceutical sciences. Indeed, it is estimated that from $50,000 to $75,000 are needed to train a single Ph.D.-level pharmaceutical scientist. This level of funding is simply not available through higher education institutions. Of greatest benefit are industry-sponsored fellowship programs that can be established and supported by unrestricted grants to academic institutions. For the modest sum of $10,000 per year, a fellowship can be established in the name of a company to support the education of a doctoral-level student for one year. Two such programs are currently established in the Drug Dynamics Institute (DDI) at the University of Texas at Austin; one supports students in pharmaceutics, while the second sponsors students in pharmaceutical analysis. The value of these grants is maximized, since students can be paid stipends (usually $450 to $500 per month) that are tax-free, because stipulations can be set to satisfy the regulations enumerated in IRS ruling 60-378.(16)

The predoctoral fellowship programs administered through the DDI also provide for summer industrial internship experiences. That is, a fellow can spend a summer in the sponsor's firm, where he or she is expected to work in several different areas. These are enriching experiences that have been received very favorably and are appreciated by students. While no obligation to the sponsoring firm is accrued by the fellow, the company does have an early opportunity to attempt to recruit the student following graduation.

Other academic-industrial cooperative programs could be of benefit in training increasing numbers of high-quality pharmaceutical scientists. For schools with proximity to pharmaceutical firms, joint educational programs can be established where the graduate student performs much of his or her research in the cooperating company. If carefully planned and monitored, such programs can lead to quality graduates. Additional bipartisan efforts can include adjunct faculty appointments, truly joint research efforts, and two-way sabbatical programs. Academia and industrial firms should look imaginatively at all these options. Industry should be generous in giving the moral and financial support!

## SUMMARY AND CONCLUSIONS

Current U.S. industrial needs for Ph.D.-level graduates in pharmaceutics, medicinal chemistry and pharmacognosy, pharmacology and toxicology, and pharmacy administration have been reviewed. The greatest demands appear to be in the areas of physical pharmacy, industrial pharmacy, analytical pharmaceutical chemistry, biopharmaceutics/pharmacokinetics, and pharmacology/toxicology in that order. Strategies are presented for training Ph.D.-level scientists for industrial positions. The attainment of quality in students and programs is stressed, along with extraordinary emphasis on research and research skills. A varying proportion of disciplinary and interdisciplinary research activities is proposed for graduate level education, and some suggestions are made for improving managerial and communicative skills in graduate students and their professorial advisors. Finally, proposals are offered for closer interactions between academia and industry.

## ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the many individuals from industry and education who have shared with me their perspectives on pharmacy education and/or activities of industrial pharmaceutical scientists.

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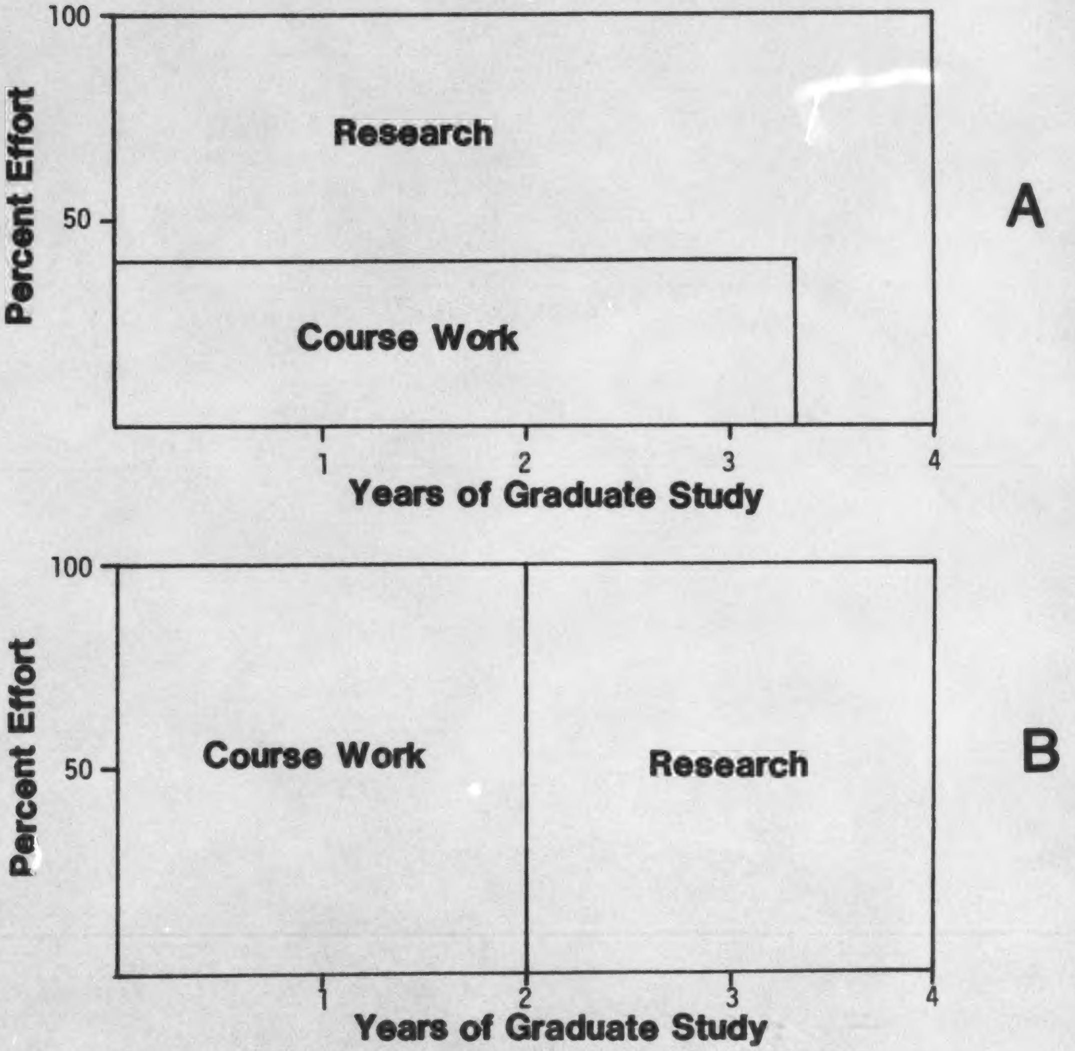
100
Percent Effort
50
Research
Course Work
1
2
3
4
Years of Graduate Study
A
100
Percent Effort
50
Course Work
Research
1
2
3
4
Years of Graduate Study
B

Fig.1. Diagrammatic representations of models for graduate study. Approximate formal course equivalents: A, 25 to 30 semester hours (~ 40% of years 0 through 3.3); B, 42 to 48 semester hours (50% of years 0 through 4).

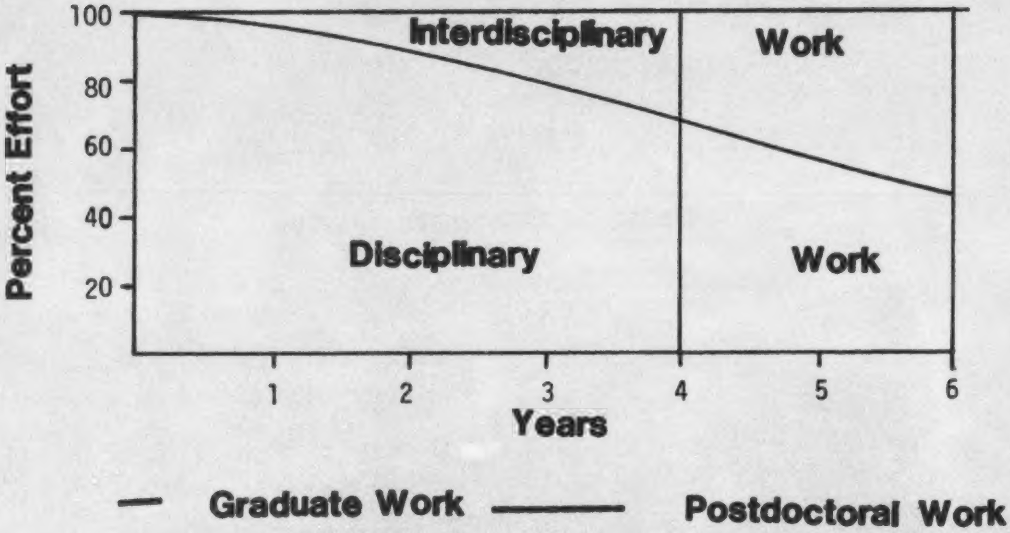

Fig. 2. Diagrammatic representation of recommended blend of disciplinary and interdisciplinary work in graduate and postdoctoral studies in the pharmaceutical sciences.

# GOVERNMENT'S IMPACT ON PHARMACY

By **Nathan Watzman, Ph.D.**, Chief of Special Programs Staff, Division of Associated Health Professions, Bureau of Health Professions, Health Resources Administration, Department of Health and Human Services, Washington, D.C., U.S.A.

As a one-time professor of pharmacology and a present-day federal bureaucrat, I am delighted to be here to share my thoughts on the blessings and perils of federal support to pharmacy schools. I share Dean Wolf's verdict that federal support has its costs as well as its benefits. . .and agree that it is sometimes inconsistent. . .but I disagree with some of his interpretations.

Even the most ardent critic of federal support and influence cannot deny the benefits produced by federal dollars. Over the past 15 years, the federal government (largely the Bureau of Health Professions and its organizational predecessors) has invested $245 million in pharmacy education—all quite apart from research funding.

Project grants—for curriculum development, clinical training, and the interdisciplinary training of pharmacy students with other health professionals—have stimulated a significant and necessary expansion of clinical pharmacy education, particularly in schools with otherwise insufficient resources.

Construction grants have expanded teaching and research facilities in 26 schools. Capitation—institutional support based on the number of enrolled students—and other types of project grants have promoted an increase in size. . .and quality. . .of faculty needed to accommodate the large enrollment increases considered essential to meet national needs.

This support began with passage of the Health Professions Educational Assistance Act of 1963. More health professionals were needed, and the needs were perceived widely. The educational community reported deteriorating facilities, and inflation—even then—was eating into school budgets. General legislation came in response, with the primary purpose of increasing the numbers of physicians, dentists, pharmacists, and others in the work force. Graduate education and biomedical research were not included.

Since that time, manpower training has been supported through five types of grant programs: student loans and scholarships; construction grants; formula-type grants; grants for financially distressed schools; and grants for special projects.

Initially, student loans and scholarships were the chief vehicle for supporting pharmacy education. Because educational programs at that time were characteristically lecture-laboratory in nature (in contrast to the clinical orientation of today), schools were able to expand their enrollments at modest incremental expense, as long as facilities could sustain the programs. However, with pressures on schools to admit more students, construction grants for new and larger buildings began to be funded.

By the early 1970s, a variety of programs were being tried and were designed to improve educational quality as well as to increase the number of students and graduates. The most important of these has been capitation. Funds are calculated on the number of enrolled students, and schools receiving grants are required to increase enrollments over those in a prior "base" year. In addition, schools receiving funds are required to maintain a given level of non-federal expenditures in order to prevent federal dollars from merely replacing existing state and private support. Subsequent health professions bills have required further efforts to increase enrollments as the reference year for enrollment increase calculations changed. Most recently, schools also were required to provide clinical instruction as a condition of eligibility for grants.

Encouraged by health manpower legislation, overall pharmacy school enrollments have doubled since 1970, and the number of practitioners in the work force has risen by 25 percent. Schools now conduct operations on a larger scale, with more faculty, more space, added clinical affiliations. . .and proportionally greater operating and maintenance costs.

Throughout this recent period of growth, however, federal funding has declined steadily. Per capita enrollment dollars under the capitation program fell from a high of $750 in 1974 to $187 in 1980. Where capitation provided nearly 20 percent of the schools' operating budgets in the mid-1970s, it now represents about 5 percent. For this reason, schools are beginning to decide they cannot afford the required enrollment increases, and we estimate that approximately 12 of 72 schools will not seek or receive capitation grants this year.

The history of special project funding shows a similar pattern. Beginning in 1970, competitive special project grants were initiated to meet national priorities. Originally, these included enrollment increase, recruitment and retention of minority students, interdisciplinary team training, and shortening of the training period through 11-month programs. Awards have been made for curriculum innovation, again with special emphasis on clinical pharmacy. Discretionary funds for these purposes were awarded last in 1977, by which time 45 pharmacy schools had benefited from one or more multi-year grants.

Pharmacy student loans and scholarships provided an average of $400 per student enrolled when they peaked in 1974. Subsequently, the loan and scholarship program has been quite limited.

In contrast to the style of "first dollar" support seen in the capitation and student support programs, the federal government initiated a grant program in 1972 for those schools in financial distress. This could be considered a "last dollar" approach, with the government supplementing institutional funds to make up budget deficits. The conditions of award require a management study to identify remaining problems that need attention. Three pharmacy schools have received support under this program. One received funds for two years before deciding to close. These funds are requested most appropriately by private schools, as publicly-supported schools receive the major portion of their funds from state appropriations.

What has been the result of 15 years of governmental support of pharmaceutical education? The schools are producing a better pharmacist—more knowledgeable about the effects of drugs on the patient, more knowledgeable about information resources he or she will use in practice, and more involved and comfortable in dealing with other professions. This has led to better quality of pharmacy care today. Basic federal support programs, grants for interdisciplinary training, support of drug information programs, and construction in medical complexes have been stimulating forces which have been responsible in part for a higher standard of pharmacy practice.

Even so, the benefits of governmental support have accompanying costs. One of these is that such support does not last forever.

Government funding of pharmacy education in this country is much less today than it was even a few years ago. When the government's reason for funding disappears, funding disappears. In the case of pharmacy education, programs geared to stimulate enrollment increases did their work too well. National shortages of pharmacists are no longer evident, and no issue of comparable magnitude has captured and focused legislators' attention on the need to support pharmacy education.

As a result, some schools are left with large physical plants and large enrollments which they may have trouble sustaining as federal support declines and the decreasing appeal of the profession makes first-class students harder to attract.

Further, solutions that seem applicable to one health profession tend to be applied, sometimes indiscriminately, to all. Shortages of physicians or specific problems in medical education can result in funding preferences that are generalized to pharmacy. . .not always with happy results.

Legislative requirements for grant eligibility can be slow to reflect changing situations in the real world. Requirements for enrollment increases or maintenance as a condition of eligibility may persist in the face of "real world" practitioner surpluses.

Short-term legislation with constantly changing funding priorities can prevent stabilization of educational planning for programs that depend on federal funds.

Congressional appropriations that occur very late in the fiscal year. . .and the prospects of rescission, or appropriations rollbacks. . .similarly complicate planning and budgeting for the coming academic year.

The development of legislation necessarily requires balancing of interests and the art of compromise—extended periods of time—and the necessity of obtaining agreement from both houses of Congress. Thus, the final legislative package may not fit educators' perceptions of their true needs.

The list could be extended; it shows how legislative language, the legislative process, regulations, and vested interest groups are all forces which impact on pharmaceutical education. The moral is that living with and depending on government patronage is not easy.

One other problem is particularly with us in pharmacy education today. Federal manpower programs designed to lead the field toward one goal and other government regulatory actions not specifically aimed at manpower production may push and pull educational programs in conflicting directions.

Today, a variety of federal programs are simultaneously encouraging and discouraging the movement toward clinical pharmacy. Health manpower legislation, specifically the capitation authority, requires that schools teach clinical pharmacy in order to be eligible for grants. Residency programs of the U.S. Public Health Service and the Armed Services, the primary care practitioner programs in the Indian Health Service, and certain Medicare-Medicaid regulations that provide for monthly drug regimen reviews by pharmacists in skilled nursing facilities all tend to expand the role of the pharmacist.

On the other side, legislative restrictions generated by inflation and cost consciousness operate in precisely the opposite direction. Medicare-Medicaid regulations generally fail to reimburse pharmacists adequately for clinical services, thus reducing the incentive to provide consultation. Maximal Allowable Cost (MAC) regulations of the Social Security Administration set a ceiling on reimbursable drug costs. The patient package insert (PPI) program of the Food and Drug Administration, which Dr. Wolf mentioned, requires that printed drug information accompany the transfer of the prescription to the patient. Quite the contrary to Dr. Wolf, I suggest that in this case the printed word tends to substitute for consultation with a pharmacist. . .another disincentive to clinical education.

As Congress attempts to improve health status and the efficiency of health delivery, its regulations nevertheless tend to polarize pharmacy practice. As a result, pharmacy educators and educational institutions must bear both the charge to produce a practitioner more relevant to society's needs for clinical expertise and a reimbursement system that does not reward such services adequately. The resulting problem is not strictly of the government's making, but it is real, nevertheless.

I disagree with Dr. Wolf that restrictions on federal funds set "dangerous precedents" for federal control of educational curricula. We are, after all, talking about incentive funding which can be declined or not competitively sought. Furthermore, clinical pharmacy activities are the sole programmatic requirements of the capitation grant; this is the direction the schools have been moving anyway and what they lobbied for in Congress.

The danger, I think, comes when schools allow themselves to rely too heavily on federal funds for expansion.

Economic realities now force the government to make hard decisions on programs that promote the nation's health. As other priorities gain the interest of Congress, schools of pharmacy, along with other health professions, must look for other sources of support. Further, the student applicant pool is decreasing in most health professions, including pharmacy, making it difficult for schools to maintain enrollment requirements as a result, and additional schools may have to withdraw from programs such as capitation, further reducing revenue.

I think that most pharmacy schools will be able to survive with reduced federal support, but they will have to set limited goals based on their resources. Not every school can develop a clinical program comparable to those in academic health centers. Not every school should try.

My message for you is simple. Should you contemplate mobilizing support for pharmaceutical education from your government, be aware of the need for a single, comprehensive policy toward health professions education and practice. Be aware that not all of government's well-intentioned programs will have precisely the implications you expect. . .and be aware of the costs, as well as the benefits.

# Moderator's Opening Remarks
# Session on Pharmaceuticals for Developing Countries

**Lawrence C. Weaver, Ph.D.**, Dean, College of Pharmacy, University of Minnesota, Minneapolis, Minnesota, U.S.A.

About 30 years ago, the U.S.A. announced that it would make its highly valued technology available for the development of badly impoverished nations of the world. Biomedical technology, especially that related to pharmaceuticals, surely was high on the list. The emphasis placed on pharmaceuticals for developing countries has varied in the ensuing years. In recent years, this interest has increased a great deal.

The Institute of Medicine of the National Academy of Sciences in 1978 reported a study, "Strengthening U.S. Programs to Improve Health in Developing Countries". Of the seven recommendations, one was concerned with drugs:

> Working with and through WHO, the U.S. should assist developing countries in designing pharmaceutical quality standards and the administrative and legal mechanisms to enforce them. In appropriate circumstances, the U.S. should assist developing countries to strengthen their pharmaceutical production and distribution capabilities. Steps should be taken to stimulate R & D activity in the U.S. academic and industrial biomedical research establishments to develop new vaccines and therapeutic drugs for the endemic diseases of the less developed countries.

In January 1979, the Institute of Medicine held a Conference on Pharmaceuticals for Developing Countries. This three-day conference, chaired by Dr. Leighton Cluff, considered the following major topics by a distinguished faculty:

1. Major disease problems of the developing countries: the current status of preventive, prophylactic, diagnostic, and therapeutic agents.
2. Current programs for the development of pharmaceuticals.
3. The scientific base: Opportunities for research.
4. Strengthening incentives and overcoming disincentives: A call for action.

The proceedings of this conference is a must for anyone interested in this area of need.

Two months after this conference, another, the 1st Drug Symposium in Saudi Arabia: Appropriate Use of Medicines, was held in Riyad, Saudi Arabia. This broadly based conference touched on nearly every aspect of drugs, including certification, licensing and registration, distribution, quality assurance, formularies, and use. The proceedings will be available soon from the School of Pharmacy, University of Riyad.

We are privileged this morning to have two internationally known scientist educators to share with us new insights into pharmaceuticals for developing countries. Like you, I am looking forward to their presentations.

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# FORCES AFFECTING PHARMACY EDUCATION

By **Harold H. Wolf, Ph.D.**, Dean, University of Utah
College of Pharmacy, Salt Lake City, Utah, U.S.A.

Pharmaceutical education in the United States is subject to a variety of powerful forces capable of altering both its direction and its quality. Evident among such forces are: the state of local and national economies; the national and local political climates; the nature of the potential student pool; the status of societal commitment to health care; scientific advances which expand the professional knowledge base; faculty attributes and quality; advances in health care and teaching technologies; changing demographic characteristics of American society; public concerns with evidence of continuing professional competency; and the extent of the federal government's involvement in our educational enterprise.

Predicting the specific impact of such forces is difficult, because they frequently interact in conflicting ways. For example, as our population ages, the problems of geriatric health care become more prevalent, enjoy greater visibility and receive greater attention from governmental planning agencies which design new strategies to meet the expanded needs of the elderly population for adequate health care. This increased interest in gerontology stems not only from an awakened public consciousness which perceives the needs of the elderly as real and pressing but also from the emerging political clout possessed by the elderly as they come to represent a significant portion of our population. In any event, as a result of this societal interest, new modes for geriatric health care evolve, some of which require pharmacists skilled in geriatric therapeutics for successful implementation. Observing the scarcity of pharmacists with such competence, most of our colleges proceed to modify existing curricula to rectify the deficiency, and some undertake pilot educational programs designed to produce a new specialist, i.e., the geriatric clinical pharmacist. The colleges do this both out of a sense of obligation to help meet identified, unfilled health care needs and in recognition of an opportunity to expand professional practice prerogatives. Moreover, the motivation to embark on such ventures may be catalyzed by a strong economy and the availability of federal funding for the resources needed to initiate most new educational activities.

When the forces described above interact harmoniously over long periods of time, i.e., at least a decade, the outcome is likely to be reflected in clear and demonstrable changes in the manner in which pharmacists are educated and practice their profession. A good case in point is the evolution of clinical pharmacy training and practice in recent years. On the other hand, it is quite possible for such forces to conflict in ways which are disruptive to academic planning and which militate against achieving once agreed upon objectives. Thus, at a time when the therapeutic needs of the elderly are increasing in our aging population, we find ourselves now faced with a weakening economy, numerous competitive societal commitments (e.g., to defense, to new sources of energy, and to environmental protection) and a voracious health care system which already consumes approximately ten percent of our gross national product. This constrains the resources available to pharmaceutical education and diminishes the probability of sustaining the curricular changes and pilot projects described above for a period sufficiently long to judge their value. If, as a result, these or similar educational endeavors are prematurely abandoned prior to gauging their impact on the problem for which they originally were proposed, time, effort, and fiscal resources are all expended wastefully, and the programmatic changes may have no lasting merit.

Although pharmaceutical educators have little control over broad factors such as the strength of the economy and fluctuations in societal commitment to health care, we do have a responsibility to recognize that these forces may well limit our capacity to sustain programmatic experiments which are dependent upon external and unstable fiscal resources. It would seem prudent to reflect upon this constraint when planning major changes in the thrust of our academic programs.

Ample evidence exists which indicates that, in recent years, the characteristics of the applicant pool of students seeking admission to our programs has changed markedly. The number of applicants has declined by an overall average of 32 percent from the peak years of applications (1975-77). Actual enrollments have decreased by eight percent. In times of peak enrollment, the applicant:enrolled student ratio was 3.0:1.0, whereas in 1979 this ratio was only 2.1:1.0. Moreover, the vast majority of admissions officers in our institutions believe that the quality of students applying to our programs has decreased in the past five years. (1) Although a full understanding of the factors which might be responsible for this decline in applicant pool remains to be determined, it seems obvious that the phenomenon could be a potent force affecting our educational endeavors.

One possible outcome of declining enrollments could be a rapid catalysis of the movement toward the Pharm.D. degree as the appropriate educational level for entry into professional practice. As schools wrestle with the impact of shrinking baccalaureate enrollments and fight to protect their base budgets and preserve their existing complement of faculty, it is likely that many will view this as a propitious time to phase out baccalaureate education in favor of Pharm.D. programs. The latter, with established requirements for low student to faculty ratios and concomitant justified increased educational costs (per student), could present an attractive and defensible alternative to budgetary and personnel cutbacks. Moreover, the faculty, when faced with a choice of accepting mediocre students in order to maintain baccalaureate enrollments or retaining selectivity in the admissions process as part of a smaller Pharm.D. program, well may opt for the latter. Thus, the long-standing debate over this issue, which began with lofty considerations of educational goals, societal needs, and professional competencies, may be resolved by forces far more pragmatic.

Accompanying the decline in enrollment of traditional students is a growing interest on the part of many practicing pharmacists in training leading to additional competence and the award of the professional doctoral degree. These practitioners are motivated both by a desire to upgrade their skills—especially in the clinical areas—to a level commensurate with that achieved by today's graduate and by a fear of premature professional obsolescence and subsequent economic hardship. It also must be noted that these individuals are understandably unwilling to sacrifice existing careers to pursue this type of training. Thus, their fervor to further their education is often tempered by an equally strongly-held view that these competencies must be developed through mechanisms other than full-time study.

As the number of practitioners embracing this view intensifies, so also will the pressures on our academic institutions to create and expand nontraditional modes of teaching and learning.

If, as a result of diminished interest in baccalaureate pharmacy programs, Pharm.D. level training emerges as the standard for American practice, two additional outcomes are plausible; both can have a marked effect on curricula and programs offered in our institutions. First, heightened interest in academic-based pharmacy technician programs is likely to occur. This could result both from a philosophical desire of academicians to control all levels of training for pharmacy practice and from a practical concern with maintaining the institution's enrollment base. A second outcome could be the proliferation of recognized professional specialties, e.g., pediatric clinical pharmacist, drug information specialist, clinical toxicologist, etc. (with attendant additional formal training and subsequent certification), as individuals and colleges strive for identification and recognition as distinctive and distinguished entities.

Finally, if the number of students in the baccalaureate pool remains depressed for any long period of time, we are likely to observe an increased amount of institutional diversification into nontraditional, nonpharmacy areas. One such area for which precedence already exists is that of training allied health professionals. Thus, educational programs at associate, baccalaureate and postbaccalaureate levels for preparing medical technologists, radiological technicians, occupational therapists, and others may develop in a number of integrated colleges of pharmacy and allied health professions. Diversification of this magnitude obviously would have a very significant effect on college goals and objectives and could re-shape the fundamental character of the institution and its faculty.

While the characteristics of pharmacy faculty may be altered gradually by changes in the basic mission of an institution, other forces now prevailing in our society may have a more direct and greater long-term influence in this regard.

The AACP Argus Commission noted recently that the decline in the academic job market and the removal of mandatory retirement requirements well may have a significant effect on the turnover of faculty—an essential act of rejuvenation—and easily could lead to a situation in which the vast majority of pharmacy faculty are tenured and aged. (2) While universities generally have not set percentage limitations on the number of tenured faculty, this may become future policy if older faculty members choose to remain with the school for significantly longer times than is now true. The modal age of tenured faculty members in four-year institutions in 1980 is 36 to 45; in the year 2000, it will be 56 to 65. In the latter year, there will be far more faculty members over age 66 than there will be faculty members age 35 and younger. (3) If, as a result of the "graying" of the faculty, research productivity and scholarly accomplishments decline, teaching effectiveness also will suffer. If this happens, additional inducements might be needed to facilitate faculty turnover. These could include greater rigor in assigning merit raises, programs for partial retirement, financial inducements for early retirement, review of tenured faculty, and contract systems as a viable alternative to tenure.

There is probably no greater force likely to affect pharmacy education than the nature and quality of our faculties. It is absolutely essential that they maintain currency in their disciplinary subject matter if our academic programs are to prosper; however, there is mounting evidence which supports the view that maintaining such currency may be increasingly difficult in the years ahead. In speaking to this problem, Edward J. Kormondy (4) points out that the state of potential stultification of faculty results from a combination of factors, some internal to institutions of higher education and others developed outside them. Budget cutbacks resulting from declining enrollments and loss of confidence in the ability of higher education to deliver are restricting already tight sabbatical leave and professional travel opportunities. The changing retirement policies described earlier tend to minimize the infusion of new talent. Exacerbating these limiting factors are the erosional effects of double-digit inflation. All this while, science and the knowledge base in professional fields advance explosively. We must seek creative ways to assist faculty in their efforts to maintain competence. One approach might involve encouraging our colleagues in the pharmaceutical industry to expand the opportunities available for faculty to spend short work-study leaves in their companies. A second could encompass routine faculty exchange programs between our academic institutions. A third simply would require greater recognition on the part of our college administrators that faculty must be provided, within the course of their day-to-day obligations, the time needed to re-charge their enthusiasm for scholarly pursuits and the continued mastery of their discipline. It is worth remembering that time-consuming nonscholarly work may lead to intellectual death at any age.

An additional faculty characteristic should be considered as we examine forces affecting pharmaceutical education: in recent years, our colleges have added large numbers of clinical personnel to their faculty rolls. These individuals, who are largely trained to the level of the Pharm.D. degree and who provide the bulk of the didactic and experiential-based clinical instruction for our students, now constitute, by far, the largest disciplinary group of college of pharmacy faculty. They already have altered the direction of pharmaceutical education by virtue of their influence on the form and substance of the curriculum and their provision of innovative types of pharmaceutical service. They also have made their presence felt as colleges re-evaluate the traditional criteria which serve to govern the process of promotion and tenure. There can be little doubt that as these faculty members mature in terms of years of service and future contributions to pharmaceutical education, they will assume increasingly important leadership positions within our colleges—and that leadership is likely to refine and re-shape our academic missions.

Although I am confident that this evolutionary change in the nature of our faculties and our academic leaders well may strengthen our professional offerings, I am less sanguine about the future of our graduate programs in the pharmaceutical sciences. At the very time we are enjoying a massive increase in clinically trained faculty, we also are experiencing great difficulty in identifying resources needed to enhance the size and strength of our basic science faculty. This is a reflection of the decreased national emphasis on and support for the training of biomedical scientists. Unless this erosion of support for academic biomedical research and training is halted, we are soon likely to find ourselves with a paucity of basic science faculty because of exclusive or excessive emphasis on the production of service-oriented professionals. An inevitable consequence would be a deterioration of professional education.

No discussion of current forces affecting pharmaceutical education could be considered complete or credible without some focus on the role played by the federal government. All who have been involved with U.S. pharmacy over the past decade recognize the significant impact which federal funding has had on the development of both our research and our educational programs. With respect to the latter, the most obvious benefits have been those made possible through institutional funding provided by the Bureau of Health Manpower since 1970. A partial listing of major academic changes which stem directly from this support would include: a marked increase in faculty strength, with the faculty size in some of our institutions increasing by more than 300 percent; the creation of the vast majority of our clinical programs; the widespread utilization of role-model practitioner/educators and the move toward significant amounts of experiential academic offerings; the complete overhaul of the professional curriculum, along with a thrust toward competency based education; the emphasis and importance placed on mastering communication skills; and the movement, both philosophical and physical, of faculties and programs from cloistered didactic settings to the patient care arena. All of these events have contributed to shaping the current thrust of pharmacy practice, and most would have developed far more slowly or not at all without federal support.

Our research-oriented institutions also have derived significant benefits from grant and contract support provided primarily by the National Institutes of Health. The availability of these competitive funds has enabled a limited number of our colleges to offer high-quality graduate training programs and certainly has catalyzed the research efforts of our most productive pharmaceutical scientists.

Although few would agree with a view that our colleges and faculties would be better off without federal support, most who have received such funds have come to realize that there are "costs" as well as "benefits" inherent in this form of support. And, unfortunately, the "costs" seem to escalate in an inflationary way, while the "benefits" are subject to continuous rescission.

There is an old adage which states, "He who pays the piper can call the tune." It is also abundantly evident that when the federal government pays for a large part of the orchestra, it can dictate the composition of most of the musical program! Thus, those colleges which received institutional (capitation) support eventually were required to institute curricular changes, largely in the area of clinical pharmacy, in accord with federal directives. However beneficial these curricular modifications and however positive the demonstrated outcomes (and I personally believe the modifications were very beneficial and the outcomes enormously positive), there is something terribly wrong when we permit federal bureaucrats to mandate what is taught and learned in our professional programs.

It long has been held sacred in American academic institutions that the design of a curriculum and the responsibility for its upgrading and modification are inviolate faculty prerogatives; any dean who forgets this dictum does so at considerable risk and peril. And yet, we now have an established—and, in my view, dangerous—precedence for the federal government to determine the academic thrust of entire professional programs. Thus, the potential exists for future federal intervention in curricular matters with accompanying philosophical "costs" of considerable magnitude.

Federal actions also influence our academic offerings in more subtle ways. Two examples will suffice. In response to national concerns with increasing health care costs, and because a good portion of these costs are borne by the federal government, many states have been convinced to repeal or modify their existing antisubstitution laws, thus allowing pharmacists to select the specific brand of drug to be dispensed in cases where the prescription calls for a product available from multiple pharmaceutical manufacturers. Some states have coupled this legislation with requirements that the phramacist counsel patients concerning such medication. Additional federal legislation is pending which would require the enclosure of a patient package insert with several types of medications that are dispensed routinely by pharmacists. The purpose of such inserts is to enhance the patient's understanding of the drug being used. In both of these examples, pharmacists must exercise considerable professional judgment, must draw upon a current and sophisticated knowledge base, and must possess reasonable communicative skills. Obviously, our academic programs must be structured in ways which ensure that these competencies are present in those whom we graduate and that such skills can be imparted to older practitioners through opportunities for continuing their education.

In concluding this brief consideration of examples which illustrate how the federal government influences academic activities, I am compelled to comment on the government's seemingly obsessive need to regulate excessively all that it chooses to support. All who seek or receive federal funding today are faced with an ever-increasing compendium of rules, regulations and procedures which must be adhered to if new support is to be obtained or if previously pledged support is to be continued. With a variety of our innovative academic endeavors and most of our research activity now heavily dependent upon federal funding, we find the government all too willing to hold such programs hostage to well-intentioned desires to correct social injustice or to improve fiscal accountability.

Philip Abelson recently reported that, in the area of research alone, there are no fewer than 59 different federal laws and regulations with which to contend. (5) Certainly, this represents but a fragment of the regulatory requirements affecting our total academic enterprise. The costs, in terms of time and energy, of complying with these rapidly proliferating federal regulations are enormous. Thus, Abelson points out, the fraction of grant funds actually devoted to conducting research is, in many instances, two-thirds or less of what was awarded to pursue the investigation. I certainly would agree with his observation that our politicians and bureaucrats do not seem to understand that for research to be vital, creativity must take precedence over detailed bookkeeping and that demands for unrealistic accountability destroy faculty morale and hinder the progress of research.

If we are to obtain any relief from the stifling and oppressive regulations which currently accompany federal funding, we must marshall support from the entire academic community involved in the training of health professionals, the provision of health care, and the conduct of biomedical research. This community must immerse itself in both educational and political efforts. Society must be convinced that our academic endeavors are indeed worthy of public trust and support, and politicians must be persuaded that our current regulatory burden is excessive and is frequently counterproductive to the purposes for which academic institutions exist.

In summary, there are numerous, varied, and powerful forces which influence pharmaceutical education in the United States. Although certain of these are not subject to the control of individual educators, an appreciation of the scope involved is very important, for such forces well may influence institutional planning, can have an impact on professional careers, and certainly can determine longterm job satisfaction.

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## CONTRIBUTED PAPER SESSION ONE

### — Abstracts —

Presiding: **John Lach, Ph.D.,** Professor, The University of Iowa College of Pharmacy, Iowa City, Iowa, U.S.A.

### THE DEVELOPMENT OF A HEALTH CARE PROGRAM AT RIYAD UNIVERSITY.

**A.A. Ageel, A.A. Al-Badr** and **A.C. Ellison,** Riyad University College of Pharmacy, Riyad, Saudi Arabia.

Riyad University College of Pharmacy currently is seeking and providing new pathways to solve the problem of insufficient medical health care to meet society's needs. Riyad University recently introduced the Conjoint Program and intensive English course to serve as a conduit for capable students to attend the allied health colleges. This paper deals with the mechanisms of the program and its augmentation in the College of Pharmacy to produce a vital link in the Health Team Concept, "The Clinically Oriented Pharmacist".

The main thrust of the program is to define and update the current curricula in terms of society's needs. At present, the entire curriculum of the College of Pharmacy has been updated, revised, and expanded to include the clinical program. In the final analysis, what is needed to augment the newly developing programs are recruiting of more competent staff members and the expansion of the continuous education program by which previous graduates and present practitioners of the health team can be made aware of new products and methods to facilitate medical health care.

### DEVELOPMENT OF PHARMACY EDUCATION IN NIGERIA.

**P. Iwe. Akubue,** Department of Pharmacy, University of Nigeria, Nsukka, Nigeria.

Pharmacy education in Nigeria began in 1899, when the training of dispensers began in the form of apprenticeship with an examination for a dispenser's certificate.

In 1927, a School of Pharmacy for full-time students was established in Yaba, Lagos. The students, after a three-year course, were awarded the chemist and druggist diploma, which allowed them to own pharmacies. A second school, opened in 1930 in Zaria for training dispensers, was upgraded in 1961 for the chemist and druggist diploma.

The Department of Pharmacy of the Nigeria College of Technology, Ibadan, established in 1955, took over the functions of the school at Yaba and later, in 1963, became a department of the University of Ife. A degree course was then introduced. In 1968, Ahmadu Bello University, Zaria acquired the School of Pharmacy, Zaria and started a degree program. The third and fourth schools of pharmacy were established by the University of Nigeria, Nsukka (1967) and the University of Benin, Benin (1971) for the award of the degree in pharmacy. All four schools have graduate programs in all or most areas of pharmacy.

### THE CONCEPT OF A THEORY OF PHARMACY PRACTICE. **D.C. Brodie** and **William F. McGhan**, School of Pharmacy, University of Southern California, Los Angeles, California, U.S.A.

The history of pharmacy and pharmacy education will record that reform was initiated in the 1970s when the clinical pharmacy concept was implemented in both practice and education. Had there been a generally held theory of pharmacy practice prior to the introduction of "clinical pharmacy", the theory undoubtedly would have undergone marked change as a result thereof.

The concept of a theory of professional practice is not easy to grasp, and most practitioners and educators are reluctant to deal with it. A theory is often defined in relation to phenomena observed in the life and physical sciences and mathematics which can be developed, verified and formulated into a principle. The theory of relatively is a well-known example. Theory also may be defined so that it applies to phenomena (systems, for example) that are much less specific and less exact than those in the physical sciences.

Successful men and women in the world of business must have a clear theory of business enterprise in general and must understand the theory of supply and demand in economics. By the same token, there should be a generic theory for the practice of the health professions in general and a specific theory for the practice of each of the autonomous professions. From this it follows that one objective of pharmacy education should be the development in students of the capacity to deal with the concept of a "theory of professional practice".

### SPECIALIZATION OF THE PHARMACIST IN "CLINICAL BIOLOGY" ("BIOLOGIE CLINIQUE"). **A. Defalque**, College of Pharmacy, University of Louvain-la-Neuve, Belgium.

The author envisages the imperatives of both the mission and education for this orientation, which is open for the pharmacist in numerous countries. He considers the problem of a desirable harminisation of the education program. Finally, he emphasizes the main advantages to the profession of seeing more pharmacists devote themselves to this specialization.

### HOSPITAL PHARMACY TRAINING VISIT BY UNIVERSITY OF EL-FATEH PHARMACY UNDERGRADUATES IN ENGLAND. **Yehia M. Dessouky** and **Saadeddin El Migirab**, Faculty of Pharmacy, University of El-Fateh, Tripoli, Libya.

A two-week condensed course (approximately 20 lectures) was arranged by the University of Bath, England. Lectures and training were under the supervision of experts and specialized staff members. Each day, the class was divided into tutorial groups of five or six students to discuss various aspects of the day's lectures.

At the end of the two weeks, students were divided into two groups, and each group visited four hospitals or infirmaries. In addition, every three students, as a group, were asked to submit a combined report on different subjects which already had been discussed.

On the students' return to Tripoli, they were asked to answer a questionnaire consisting of 16 questions (9 scientific questions and 7 questions concerning the students' opinions, criticisms, suggestions, difficulties and problems which they faced).

The response was great with a feeling that they were keen and proved that they had learned a lot in general and much about hospital pharmacy in particular. Some valuable opinions, ideas, and suggestions were mentioned. In addition, some very important criticisms and disappointments were discussed freely, and we hope these will be avoided in future programs.

## THE GROWTH OF CLINICAL PHARMACY AT RIYADH UNIVERSITY. **Arthur C. Ellison** and **A.A. Al-Badr**, Riyadh University College of Pharmacy, Riyadh, Saudi Arabia.

This program initially was offered as a four credit hour course in therapeutics coupled with an introduction to hospital pharmacy administration at King Faisal Hospital, available as an elective in the fourth year through the Department of Pharmacology. Further planning and evolution of the new pharmacy curricula in late 1979 resulted in 30 additional hours of credit to be given by the newly-created Department of Clinical Pharmacy.

The aim of this department is to instill in the student a thorough knowledge of therapeutics and the pharmacodynamics of drug interaction, as well as to provide the student with the actual clinical experience that would give first-hand knowledge in the interrelationship of the medical problems of disease, its therapy, and the treatment courses of the patient. This would be correlated with lectures based on case histories of related disease syndromes.

We believe that this approach is necessary, since, in the final analysis, if one uses a purely academic approach to drug therapy, via case histories and drug lectures, one produces only a more proficient pharmacist and not a clinically oriented pharmacist.

## CLINICAL PHARMACY IN THE THIRD WORLD — A PLEA FOR HELP. **E.H. Froese**, Department of Pharmacy, Faculty of Medicine, University of Zimbabwe, Salisbury, Zimbabwe.

There is a great opportunity for the patient-oriented pharmacist in countries other than America. A great need exists in these developing countries for the improvement of health care services. The opportunities are unlimited for a pharmacist with the right attitudes, the desire to help others, a yen for original research, and the spirit of adventure.

Zimbabwe is such a country. We in the Department of Pharmacy of the Faculty of Medicine are directly involved in the following:

1. Development of a degree course in pharmacy which includes more than 500 hours of clinical attachment.
2. Improving patient care through research in:
   burn therapy;
   in-use intravenous fluid contamination;
   particulate matter studies of locally manufactured parenteral and ophthalmic products;
   drug utilization reviews;
   bioavailability of locally manufactured products;
   intravenous therapy, including parenteral feeding;
   pharmacokinetics in cooperation with clinical pharmacology.

3. National Drug and Toxicology Information Service.
4. Preparation of a national drug formulary.
5. Medical and pharmaceutical continuing education programs.
6. Drugs Control Council — New Drug Registration (local FDA).
7. Teaching medical and nursing students, plus post-graduate nursing education.
8. Establishment of a post-graduate Diploma in Clinical Pharmacy course.
9. Promotion of better patient care by the community pharmacist through use of patient drug profiles now being adopted on a national scale.
10. Involvement in the hospital as a member of the health care team.

All of this has happened since the first intake of students in 1974. The problems have been relatively few; the rewards have been very satisfying. The acceptance and cooperation given this department by the other members of the Faculty of Medicine have been overwhelming. But we need help. The U.S.-trained clinical pharmacist can help by coming to us as a permanent member of staff or on a one-or two-year attachment, or even on a rotational basis from one of the university pharmacy schools. The experience gained by such a venture is unequalled and never to be forgotten. The return trip is paid for, accommodations can be provided, and the salary is good.

It is strongly felt that the above can be duplicated in many emerging countries in the world. All that is needed is a pharmacist with experience, vision, and "adventure in his bones".

THE EVOLUTION OF A PHARMACY PRACTICE COURSE AT THE SCHOOL OF PHARMACY, HERETAUNGA, NEW ZEALAND. **Douglas Hancox,** School of Pharmacy, Central Institute of Technology, Heretaunga, New Zealand.

Schools of pharmacy have the task of providing an education and training in basic and applied sciences and in professional practice. In discharging this responsibility so as to achieve a proper balance of courses, the schools face important questions of curriculum content, educational process, and organizational structure.

In recent years, the School of Pharmacy at Heretaunga has been organized on a basis of the three disciplines of pharmaceutics, pharmacology, and pharmaceutical chemistry, and the respective groups of tutors have developed programs of scientific and professional courses which run in parallel throughout the three years of the Diploma course.

To achieve full and proper development of the various and separate professional courses, the school's structure has been modified to create a group of tutors concerned with the subject of pharmacy practice. A program of study has been developed to run alongside modified programs in the other three disciplines. An important feature of the new structure is that members of the pharmacy practice group will remain members of their previous groups and promote improved integration among the school's various activities.

## CONTRIBUTED PAPER SESSION ONE

— Abstracts —

Presiding: **Nicholas Flagbe, Ph.D.**, Professor, Faculty of Pharmacy, University of Science and Technology, Kumasi, Ghana

POSTGRADUATE QUALIFICATION OF PHARMACEUTICAL CADRES IN BULGARIA. **Liliana Drenovska-Noninska**, Professor, Faculty of Pharmacy, Sofia, Bulgaria.

The problem of continuity of cadres' training in conditions of the scientific-technical progress is an invariable demand in the contemporary stage of development of our society. The system of postgraduate qualification (PGQ) in its different types, forms and duration turns out to be efficient and economically profitable. It includes all the cadres according to a plan and is directed in accordance with the national economic needs.

Postgraduate qualification of the high medical cadres (doctors, pharmacists and dentists) is a part of the general system of PGQ in the People's Republic of Bulgaria. It is directed methodically by the committee of science and technical progress. The Medical Academy organizes, coordinates and conducts PGQ of the cadres using the material-technical and the cadre potential of its links and the peripheral health net.

The various types and forms of PGQ are presented, and benefits resulting from PGQ are discussed.

EVALUATION OF PHARMACY EDUCATION IN TAIWAN — FACULTY, STUDENTS, AND PRACTITIONERS. **Weng F. Huang** and **Chung-Hsiung Chen**, Food and Drug Bureau, National Health Administration, Taipei, Taiwan.

Ever since the birth of pharmacy education in this island (population 17 million) during the 1950s, there has not been any well-designed study to evaluate whether pharmacy education really produces the competent pharmacists it is purported to produce. The inflexibility of curriculum in a four-year program and the lack of manpower forecasting, combined with other factors, result in the marginality of the pharmacy profession in the health care system of Taiwan.

This evaluation is conducted to assess the outcome of pharmacy education against the expected competence of pharmacists and to examine the factors that influence/constrain any improvement of the current situation.

Questionnaires were mailed to faculty members in pharmacy schools, senior pharmacy students, and practitioners randomly selected from appropriate populations.

Analysis of the returned questionnaires indicates much to be improved in the current pharmacy program for competent pharmacist production. Implications and recommendations from this evaluative study also are described for future studies.

## TEACHING PHARMACEUTICAL CHEMISTRY (CLASSIFICATION OF TOPICS).

**El-Sebai A. Ibrahim,** Faculty of Pharmacy, University of Alexandria, Egypt.

Chemicals used in medicine and pharmacy should be presented to pharmacy students in a logical manner, including a combination of chemical, pharmacological and therapeutic classification.

The following factors govern classification of topics for teaching pharmaceutical chemistry:

1. Present day definition of pharmaceutical chemistry.
2. The major advances in the subject during the last four decades.
3. The subject is a bridge to conduct the student from basic chemistry to pharmacology.
4. The student should be made capable of understanding clinical pharmacy.
5. Teaching of this subject should be palatable to the student and useful in the student's future dealing with the physician and patient, whether in the laboratory, the hospital, or the community.

How will this classification be attained with a curriculum directing the student toward the patient and not away from medicaments as chemicals?

The answer will be given.

## THE EVOLUTION OF PHARMACEUTICAL EDUCATION AND PHARMACISTS IN JAPAN SINCE WORLD WAR II.

**Chikataro Kawasaki** and **Eiichi Akaho,** School of Pharmacy, Kobe-Gakuin University, Kobe, Japan.

Although pharmacists in Japan had increased from 52,418 in 1955 to 100,897 in 1977, the number of owner pharmacists in community practice was practically unchanged — from 13,551 to 14,518, while hospital pharmacists had increased from 8,000 to 21,584. Since the new college system and the national examination for pharmacists were introduced in 1949, pharmacy education in university standard has grown to 44 colleges with 34,880 students (4 years) in 1979; in the meantime, 124,536 graduates had passed license exams.

The rapid development of health insurance systems covering the whole population had brought a close connection between medicine and the drug industry without the professional services of community pharmacists; irrational prescribing and dispensing by physicians existed. Hospital pharmacists have worked hard to cope with the advance of drug therapy but have been too busy dispensing to serve patients in clinical pharmacy practice. Basic sciences in education have been emphasized more than the clinical sciences; graduates from public or governmental schools are research-minded, often successful as pharmaceutical scientists. The majority of them have come from private schools, and they are eager to enter hospital pharmacy, with fewer eager to enter industry (as detailmen) and a few community practice. Female graduates, who comprise more than 60 percent of the total, will be confronted in the future with equal partnership or to drop out. Japan, as the best medicared nation with a neglected profession of pharmacy in the social security systems.!

## PHARMACEUTICAL EDUCATION AND THE EUROPEAN COMMUNITIES.

**Helmer Kofod,** Royal Danish College of Pharmacy, København, Denmark.

Endeavors to unify European education in pharmacy were initiated under the auspices of The Council of Europe in 1973, the aim being "to reach agreement on the desirable level of academic attainment in pharmaceutical studies and its evaluation".

In 1976, the project, involving the 21 member states had to be discontinued. It was, however, carried on within the nine member states of the European Communities (the Common Market), although on a different background.

The principle aim, being from the outset of a purely academic nature and derived from the general idea of European unity, was now reformulated as "to achieve free movement of (pharmaceutical) goods and personnel", which, as a consequence, required an equivalent standard of education and mutual recognition of diplomas.

The author, who has taken part in the project from the beginning, will outline the development and present status of the project and will mention current problems and trends.

## CLINICAL PHARMACY EDUCATION AT THE SCHOOL OF PHARMACY, UNIVERSITY OF LOUVAIN (BELGIUM).

**M.L. Lesne,** University of Louvain, Bruxelles, Belgium.

Three years ago, a clinical pharmacy seminar was introduced into the curriculum of the specialization in hospital pharmacy. It consists of two parts: clinical pharmacokinetics and clinical pharmacy. The course in clinical pharmacokinetics has a duration of 45 hours, and many exercises are given to the students. In the clinical pharmacy course, many cases of drug prescription, drug interactions and side effects are reviewed; the students are able to utilize the drug information centers to make rapid literature searches.

The drug information center is equipped with IOWA microfilms, specialized books on pharmacology, toxicology, pharmacokinetics, pathology, index,. . .and documentation available on each drug marketed in Belgium.

The opportunity is offered to any student to spend two months in the intensive care service of the academic hospital (750 beds). The experience of each student consists of: evaluation of drug therapy; medical staffing literature research; drug monitoring; lectures for nurses; and contacts with the hospital pharmacy. The best students are very enthusiastic about this program; however, for the future, jobs still have to be created for those specialists.

## A REVOLUTIONARY DEVELOPMENT IN THE SYSTEM OF PHARMACEUTICAL EDUCATION IN INDONESIA.

**Sahat Lumbantoruan,** Department of Pharmacy, Bandung Institute ofTechnology, Bandung, West Java, Indonesia.

Historically, the main objective of establishing pharmaceutical education in Indonesia was to provide personnel having required qualifications, mostly of technical and art, to work in "apotik". ("Apotik" is a legal/authorized place where medicines are dispensed and distributed.) In consequence, the inherited system, which still greatly accentuates the one presently used, was oriented almost entirely toward practical aspects.

It has been realized, however, that in order to be able to keep up with the increasing demands of people — as resulted from the rapid growth of sciences and technology, the curricula of pharmaceutical education must become science oriented, providing strong basic sciences in the subjects.

Efforts have been made throughout the years. Among the many obstacles met, the one that is likely to be the most difficult to resolve is the long-held, narrow perception of society, unfortunately including pharmacists, about pharmacy as a profession, its role and function.

The paper will present an overview of the pharmaceutical education system in Indonesia, the idea of change, the obstacles, and related discussions.

## INDUSTRIALIZATION AND PRODUCTION OF DRUGS FROM MEDICINAL PLANTS IN DEVELOPING COUNTRIES. **G.H. Mahran,** Faculty of Pharmacy, University of Cairo, Egypt.

Several drugs can be produced from medicinal plants widely distributed in many developing countries having a rich flora that is a potential source of new drugs and biologically active ingredients. Developing countries should not disturb their ecological balance and should conserve and preserve the germ plasma available and forest wealth as being needed for industry. Cultivation of strategic medicinal plants is in progress. Production units are of great economic benefit in preparing extracts, tinctures, volatile and fixed oils, condiments, insecticides, active ingredients in semi-finished forms.

For the scientific production of traditional remedies, proper practice must be established for the cultivation, storage and processing of plants as well as for analysis and control of the medicaments prepared from them.

International cooperation should play a leading role in mobilizing developing countries to produce drugs from medicinal plants, taking measures to accelerate the establishment of production units and technical cooperation.

Egypt has developed a prosperous medicinal plants industry as a result of the vast developing research work in this field. Several examples of these achievements are presented.

## CONTRIBUTION OF THE BIOPHARMACEUTICAL LABORATORY COURSE TO THE UNIQUENESS OF PHARMACEUTICAL EDUCATION. **E. Menczel,** Pharmaceutical Division, Ministry of Health and School of Pharmacy, The Hebrew University of Jerusalem, Israel.

The essentials of biopharmaceutics are by now incorporated into most modern pharmacology courses given within the realm of the health sciences, but the scope of teaching is quite limited. Moreover, rarely would any biopharmaceutical principle be elucidated in any pharmacology laboratory course.

A properly established biopharmaceutical laboratory course produces a better insight into both the possibilities and limitations of the investigational work done in this field. Apart from this didactic role, in our own experience, the biopharmaceutical laboratory course contributes to the uniqueness of pharmacy in the health professions and its increasing share in the promotion of health care.

This report also will depict the main topics of the biopharmaceutical laboratory course as exercised for the past ten years in Israel.

## CONTRIBUTED PAPER SESSION ONE
### — Abstracts —

Presiding: **Judith T. Barr, M.S.,** Associate Dean, Northeastern University College of Pharmacy and Allied Health Professions, Boston, Massachusetts, U.S.A.

### THE PHARMACY EDUCATION IN BRAZIL.

**T. Myrtes Murad** and **J.E. Murad,** Federal University of Minas Gerais Pharmacy School, Belo Horizonte, Brazil.

In Brazil, there are 28 pharmacy schools, four of which are located in Minas Gerais State. The majority of them are federal schools, and the student's tuition is merely symbolic: 50 dollars per year. The pharmacy course is divided into two steps:

1. The Course of Pharmacy, a three-year program which gives to the student the title of Pharmacist, enabling him or her to work or to be the owner of a pharmacy or drug store. Only five percent of the students interrupt the Course in this step.
2. The Biochemistry Pharmaceutical Course, with one additional year of specialization in:
    a. the area of clinical analyses, with the right of working or being the owner of a laboratory for faeces, urine and blood analyses and biochemistry; or
    b. the area of pharmaceutical technology for the production or analyses of drugs and production or analyses of foods.

At the moment, there is in our pharmacy school a post-graduation course in the field of technology of foods with more than 15 students, four of whom already have obtained their master's degree. This course has been located in our pharmacy school since 1977.

### THE TRAINING OF SUB-PROFESSIONAL PERSONNEL — GHANA'S EXPERIENCE.

**John Ocran,** Faculty of Pharmacy, University of Science and Technology, Kumasi, Ghana.

The pharmaceutical establishment has never considered the training of sub-professional personnel as its responsibility and left it to the Ministry of Health to start an in-service program to produce assistants for pharmacists in government hospitals. This lapse on the part of leaders of the profession, coupled with the assistants' fight to be upgraded, have led to a situation in which pharmacists view with suspicion any attempt to improve the calibre of people who will assist them in their work.

The Health Ministry has gone further to formalize the training of assistants by persuading the Ministry of Education to start a full-time course at a polytechnic. Neither individual pharmacists nor the bodies connected with pharmaceutical practice and education have come out to support the new course, thus hampering its development.

It is asserted that by controlling or helping in the training of one type of assistant who will be useful in any branch of the profession, pharmacists will be performing a duty they owe to their profession, since failure allows the government to step in to produce an unacceptable assistant.

Ghana's situation is considered to be typical for many countries where the profession is young and the view is expressed that the presence of highly trained assistants would enable the pharmacist to play a more effective role in the provision of health care to society.

## A FLASH ON PHARMACEUTICAL EDUCATION IN BRAZIL.

**Maria Aparecida Pourchet-Campos,** Director, Faculdade de Ciencias Farmaceuticas, Universidade Estadual Paulista, Sao Paulo,Brazil.

Pharmacy and, as a consequence, its training is presently a very debatable and debated subject all over the world — and Brazil is no exception.

Although there have been several efforts to unify them, pharmacy courses in Brazil differ somewhat at various universities, partly by tradition and partly due to local requirements and facilities.

Originally, pharmacists worked in their classic profession; however, because there was a shortage in specifically trained elements, pharmacists soon were recognized as qualified to work in food chemistry, analysis in clinical and toxicologic laboratories, and even in chemical industries, a trend which was only partly beneficial, as it dispersed the concept of pharmacy over an enormous area.

At the same time, a lack of graduated pharmacists to work in public and hospital pharmacies was to be felt. Adding to this, public pharmacy was being ever more commercialized as industrialization increased.

The results, which possibly constitute our main problem today, can be felt strongly by a tendency for the pharmacist to abandon his main area and dedicate himself to collateral areas where there is increased competition from other professionals. This tendency has affected our pharmacy courses.

The fact that pharmacists can be qualified to work in several different areas may be desirable, but not the exchange of their main actuating area for collateral, highly competitive areas. A scheme of courses at the School of Pharmacy at Sao Paulo is presented to illustrate an effort to solve this problem. A host of problems remains unsolved; however, an effort is being made to qualify graduates better for their main task, from which too many have strayed.

## TORTUOUS DEVELOPMENT OF PHARMACEUTICAL EDUCATION IN INDIA.

**J.S. Qadry,** Hamdard College of Pharmacy, University of Delhi, New Delhi, India.

Pharmacy education in india began in 1931 as a two-year B.Sc. course in Banaras Hindu University. It was instituted as a B.Pharm. degree course in Punjab University in 1944 and in Gujarat University in 1947. The course of reading as approved by the above-mentioned universities was biased toward chemistry, botany or engineering. The later pharmacy course started in medical colleges was loaded with medical subjects, including even surgery. Since there was no coordinated approach, a person heading an institution had to consolidate it in his field of specialization and project his experience and impressions gained in a foreign country. Consequently, pharmacy education in India had tortuous development and hence failed to get the recognition it deserved. Even universities did not respond sympathetically, as is evidenced by its inclusion under different faculties, namely, medicine, technology, science and pharmacy.

The paper deals with pharmacy education and the pharmacy profession in India and narrates present problems and future expectations relating to various levels of pharmaceutical education; variations in curricula; non-availability of talented and properly qualified teachers; necessity of practical program during university career; replacement of specialization in four main disciplines with one subject course at M.Pharm. level; modernization of subjects; designing of need based courses; rationalization and balancing of different subjects, etc.

AN ANALYSIS OF PHARMACY EDUCATION IN EGYPT — PAST, PRESENT AND FUTURE. **M. Darwish Sayed,** Minister of Educational and Cultural Affairs, Embassy of Egypt, Washington, D.C., U.S.A.

A historical review of pharmacy education in Egypt and its relation to the medical professions is discussed. The impact of the development of the drug industry on pharmacy education for a quarter of a century, as well as research orientation, is also presented. Special concern is given to ideas aiming to graduate a pharmacy specialist in different disciplines of pharmacy, e.g., drug analysis, drug control, forensic pharmacy, industrial pharmacy, etcetera.

Finally, an overall conclusion is presented of the future of pharmacy education, and research in pharmacy disciplines, as well as interdisciplinary pharmaceutical education with other related professional education in Egypt in particular and internationally in general.

PHARMACY EDUCATION AND PHARMACEUTICAL INDUSTRIES IN INDONESIA. **Fauzi Sjuib,** Department of Pharmacy, Bandung Institute of Technology, Bandung, Indonesia.

Pharmaceutical law in Indonesia requires that every pharmaceutical industry have at least two registered pharmacists — a pharmacist responsible for production and a pharmacist responsible for quality control. A small domestic industry, however, may have one pharmacist temporarily. Pharmaceutical industries in Indonesia may be divided into three groups — foreign, large domestic, and small domestic industries. These three groups have different requirements both for quality and for the number of pharmacists employed.

The College of Pharmacy has the responsibility of teaching and training students for work in industry, as none of the pharmaceutical industries have their own training programs for pharmacists.

Interviews of numerous colleagues working in industry showed that refresher or upgrading courses in special areas are needed. The Department of Pharmacy of Bandung Institute of Technology had offered some special courses which had many participants. Graduate programs such as M.Sc. and Ph.D. degrees might not fit the needs of the pharmaceutical industries in Indonesia. In the near future, however, a specialization program would do this better.

## A RESPONSE TO CONTINUING EDUCATION COURSES FOR COMMUNITY PHARMACISTS IN THE WEST MIDLANDS, GREAT BRITAIN. **Barbara Stewart,** Department of Pharmacy, University of Aston, Birmingham, England.

Thirty government-sponsored courses have been held in the West Midlands since 1970 at nine centers throughout the region. Retrospective analysis of attendance showed participation by 1,514 pharmacists, 30 percent of whom were married women.

Two questionnaire surveys of pharmacists in the West Midlands were conducted to obtain data on attendance and attitude toward courses as a source of drug information. Pre-tested Questionnaire 1, coded for computer analysis, was mailed to 50 percent of all community pharmacists in the region. Questionnaire 2 was mailed to all married women pharmacists in the region.

Results showed that 43 percent of respondents to Survey 1 had attended courses, compared with 51 percent in Survey 2. A similar proportion in both surveys who had not attended courses agreed that a financial incentive would not encourage them to attend. Most respondents considered courses an opportunity to keep up-to-date but opposed mandatory participation.

Conclusions: Attendance figures and attitudinal responses in Survey 2 indicate that courses should be designed and offered specifically for pharmacists who have experienced periods of professional inactivity. Both surveys showed that pharmacists recognize the usefulness of courses, in spite of low attendance rates.

## STATUS OF PHARMACY EDUCATION IN INDIA. **H.P. Tipnis, A.B. Thakur** and **C.K. Kokate,** The Bombay College of Pharmacy, Kalina, Bombay, India.

In spite of the efforts of government, leading industrialists and inspired educationists, pharmacy education and the pharmacy profession in India remains largely a neglected area. This is mainly because the dispensing of drugs and community health care are still the chief domains of physicians. Pharmacists, therefore, rarely enjoy the prestige of being true professionals.

Until recently, pharmacy education in India remained a curriculum heavily oriented toward chemistry, lacking the comprehensiveness required for a pharmacy syllabus. The pharmacy colleges have become acutely aware of this shortcoming and have been striving to re-orient the trend in the right direction by introducing modern concepts of pharmacy in their educational programs and syllabi.

This paper gives an account of the overall scene of pharmacy education in India. The findings of the survey regarding the distribution of pharmacy graduates in different spheres of employment are highlighted. The status of pharmacy education in India and its future prospects are reviewed.

## CONTINUING EDUCATION FOR PHARMACISTS IN GREAT BRITAIN: A DISTANCE TEACHING PROJECT FROM LEICESTER POLYTECHNIC SCHOOL OF PHARMACY. **Norman Westwood,** School of Pharmacy, Leicester Polytechnic, Leicester, England.

Pharmacists need keeping up-to-date, and lectures at local centers attract only about 10 percent of the population. Distance teaching methods bring updating information to the doorstep, and the first nationwide scheme now is operating from Leicester Polytechnic School of Pharmacy with the financial and other support of the Pharmaceutical Society of Great Britain.

With a potential audience of 26,000 being circulated, there are large mechanism problems of appropriate validation, curriculum specification, level of support from government and other bodies, educational level, and factors operating within central institutions like the registering body. Supported by processed data from extensive and widely cirulated surveys, this paper raises these points in the light of the Leicester experience.

## CONTRIBUTED PAPER SESSION TWO
### — Abstracts —

Presiding: **Mitchell L. Borke, Ph.D.,** Professor of Pharmaceutical Chemistry, Duquesne University, Pittsburgh, Pennsylvania, U.S.A.

### PROBLEMS FACING PHARMACEUTICAL EDUCATION IN DEVELOPING NATIONS. **C.N. Aguwa** and **A. Kar,** Department of Pharmacy, University of Nigeria, Nsukka, Nigeria.

Developing nations in the Third World that are starting to develop pharmaceutical education have the distinct advantage of beginning at the up-to-date level to which the profession of pharmacy has advanced. However, in evaluating the pharmaceutical education in some of these nations, this advantage is found not to be real.

This may be due to the fact that pharmaceutical education is not fully recognized as a health profession and so is not given the encouragement it deserves in terms of funding. As a result, shortage of staff frustrates the efforts being made in pharmaceutical education.

In many of these nations, the pharmacy profession is relatively new. Thus, the type of pharmacist and knowledge needed have not been defined.

With Nigeria as an example, the discussion will focus on the problems of curriculum development, administration, funding, staffing, research and postgraduate education. This exposition will underscore those areas in which help should be rendered to the developing nations.

### THE GHANA PHARMACY BOARD AND PHARMACY EDUCATION IN GHANA. **K. Boakye-Yiadom,** Faculty of Pharmacy, University of Science and Technology, Kumasi, Ghana.

Ghana, like other West African countries, has a Pharmacy Board charged by law with the responsibility of regulating the pharmacy profession and controlling the supply, manufacture, storage, and transportation of drugs in the country. In regulating the pharmacy profession, the Board was responsible for prescribing courses of instruction and practical training for pharmacy students, providing for the examination of these students, awarding diplomas to those who were successful in the examination, and registering graduates to enable them to practice pharmacy in Ghana.

Since 1961, however, the duties of prescribing courses of instruction, practical training, examination, and award of degrees to pharmacy students have been the duties of the Faculty of Pharmacy at the University of Science and Technology, Kumasi. However, the Board ensures that professional standards are attained by pharmacy graduates from the Faculty of Pharmacy by approving establishments where these graduates must intern for twelve months, a necessary prerequisite for registration. The Board also provides a professional qualifying examination for all pharmacy graduates who wish to practice in the country.

### INCORPORATING CHINESE MEDICINE INTO THE PHARMACY CURRICULUM: SURVEY ON THE FACULTY'S OPINIONS. **Chung-Hsiung Chen** and **Weng F. Huang**, School of Pharmacy, National Taiwan University, Taipei, Taiwan.

The amendment of the Pharmacist Law permits the licensed pharmacist to practice Chinese medicine dispensing, provided he possesses "appropriate" background in such training. It attempts to expand the role of the pharmacist amid the dismal practice environment in which most physicians dispense prescriptions in their own clinics.

The definition of "appropriateness" is quite controversial; not only is it very difficult to add such credits to the current four-year program, but there also lacks consensus as to what extent of training could be termed "appropriate". The shortage of well-trained and qualified faculty members in this field, and the nature of Chinese medicine, which is different from the philosophy of Western medical science, could make such attempts self-defeating and harmful to the pharmacy profession.

This survey examines the opinions of the faculty in all pharmacy schools of Taiwan, factors contributing to the pros and cons in this controversy, and how such role expanding affects the identity of pharmacy. It may provide better understanding and alternatives in the dilemma of tradition and reality.

### MODERN AUDIO-VISUAL METHODS IN TEACHING PHARMACY STUDENTS IN LIBYA. **Yehia M. Dessouky** and **Saadeddin El Migirab**, Faculty of Pharmacy, University of El-Fateh, Tripoli, Libya.

An ultra modern audio-visual system — closed circuit television and video cassettes — is under construction at the University of El-Fateh, Libya.

The project demonstrates objects and techniques to students which cannot be seen readily with the naked eye. Students may watch important experiments which cannot be demonstrated conveniently. The system also enables the use of prerecorded materials already available from experts from other institutes who are not in a position to visit Libya.

The project is divided into:

Stage 1 — two multiple-lens cameras with macro zoom facility and built-in monitor, two video cassette recorders with editing facilities, and four large monitors with audio facility.

Stage 2 — the fixed installation in laboratories and lecture theaters. Provisions for adequate viewing facilities are achieved with low-density large screen monitors or high-density small screen monitors on each bench.

Stage 3 — the central audio-visual system for the entire University, with a distribution system sited in 30 viewing locations. All lines from the control room to the viewing locations can be reversed, enabling classrooms to be used as television studios.

### PHARMACEUTICAL EDUCATION IN DEVELOPING COUNTRIES. **Mohamed A. Eldawy**, Faculty of Pharmacy, University of Tanta, Tanta, Egypt.

This presentation provides an overview of pharmacy education in the Mid-East, its present status and future prospects. Examination of the pharmacy curricula offered by 16 schools of pharmacy in ten Mid-East nations reveals that most of the schools still offer a classical curriculum. Conventional courses and topics constitute from 80 to 90 percent of the course hours. Recent concepts of pharmacy education either are missing or they are not clearly expressed and are hidden in other subjects. Only one school out of 16 offers a formal course in clinical pharmacy (4 credit hours). Another school designates 10 hours of clinical pharmacy as a part of a pharmaceutical course. To each of the majority of educators, clinical pharmacy means a different thing. Some of those who possess a clear understanding of the concept cannot implement it. Teaching for the industry is not satisfactory, as expressed by responsibles in the pharmaceutical industry who employ graduates.

Examinations are not structured to test competences; rather, they reflect memory talents. Trials to restructure the pharmacy curriculum face severe resistance from conventional pharmacy educators. It is suggested that the WHO set up an expert group and sponsor a conference early in 1981 to discuss these problems.

TRAINING OF THE PHARMACIST IN GHANA. **N.I. Yao Fiagbe,** Faculty of Pharmacy, Department of Pharmaceutical Chemistry, University of Science and Technology, Kumasi, Ghana, West Africa.

The training of the pharmacist in Ghana began in 1897. The years 1923, 1930, 1944 and 1961 were the major phases in the development of the pharmacy school.

The certificate of competency to practice pharmacy, the Pharmacy and Poisons Board certificate and the Diploma in Pharmacy qualifications came to an end between 1963 and 1973. During the interim, students were admitted for degree courses. The intake during the early years was limited. Today we run a four-year course with initial intake of 40 students.

The practical training aspect of the course at the University is supplemented throughout the four-year course in hospital pharmacies/dispensaries, private pharmacies, manufacturing and retail sectors, and in some research institutions. Field trips are necessary for on-the-spot training.

Clinical pharmacy components are being considered at the undergraduate and postgraduate levels. Postgraduate research and course training have been going on on a limited scale. It is hoped that with improvement in our basic requirements, encouragement from pharmacy schools outside and pharmacy-educators like you the postgraduate work will be intensified to maintain the mantle and a high standard of training of the pharmacist in Ghana.

TEACHING MEDICAL SUBJECTS IN PHARMACY. **A. Ghazal,** College of Medicine, King Abdul Aziz University, Jeddah, Saudi Arabia.

Pharmaceutical studies give the pharmacist a chemical and biological background which, if wisely directed, can provide sound qualifications to share in the health welfare. There are many options, including general pharmacy, in which the pharmacist can provide information about drugs, their use, interactions, dosage, values, forms and regimens. Hospital and pharmacy administration can provide better health care at the lowest cost. Pharmacists in forensic medicine and toxicology centers serve in giving information about poisons and conduct the chemical toxicological analysis. In clinical laboratories, they perform the analysis and interpretations. The drug control and standards and drug propaganda are other fields.

The teaching of medical subjects to satisfy these goals must be organized and given more consideration. The order and credit hours will be discussed. The subjects include physiology, anatomy, histology, biochemistry, pharmacology, pathology, microbiology, parasitology, toxicology, bioassays and public health.

PHARMACEUTICAL EDUCATION IN EGYPT. **Sayed H. Hilal**, Vice-Dean, Faculty of Pharmacy, Cairo University, Cairo, Egypt.

Historical background of pharmaceutical education in Egypt is presented.

Curriculum areas of today's five-year program in pharmacy education at the Faculty of Pharmacy of Cairo University are discussed, as follows.

There is one year of pre-pharmacy coursework in the Faculty of Science, consisting of natural and biological sciences. The first year of pharmacy coursework includes: organic chemistry; analytical chemistry; pharmacognosy and medicinal plants; pharmaceutics; history of pharmacy; elements of physiology, histology and anatomy; and mathematics. The second year includes: organic chemistry; analytical chemistry; pharmacognosy and medicinal plants; pharmaceutics; and microbiology. Year three covers: pharmaceutical chemistry; chemistry of drugs; pharmaceutics; pharmacology; biochemistry; elements of hygiene; pathology and parasitology. The fourth year includes: pharmaceutical chemistry; applied pharmacognosy; pharmaceutics; industrial pharmacy; bioassays; toxicology; and business administration.

Graduate studies offered are:

a. Professional diplomas in eight different aspects of pharmacy — 12 months of study following receipt of the B.Ph.Sc. degree;
b. M.Pharm.Sc. in all pharmaceutical sciences — a minimum of two years of study following receipt of the B.Ph.Sc.; and
c. Ph.D. Pharm.Sc. in all pharmaceutical sciences — a minimum of two years of study following receipt of the M.Ph.Sc.

Future prospects presented include introduction of clinical pharmacy courses during the fourth year of pharmacy studies, to include clinical therapeutics and clinical pharmacology; and the introduction of a diploma in clinical pharmacy 12 months after receipt of the B.Ph.Sc.

A NEW PHARMACOGNOSY COURSE: RE-ORIENTATION AND RE-ADJUSTMENT. **J.S. Qadry**, Hamdard College of Pharmacy, University of Delhi, New Delhi, India.

"Pharmacognosy is the mother of all the Sciences" is a slogan that one comes across in many pharmacognosy institutions in Western countries, including West Germany. Yet, we find that all those who have undergone pharmacy training and have studied pharmacognosy as one of the subjects at graduate level fail to recognize pharmacognosy as a parent science of even the pharmaceutical sciences, let alone of all the sciences. One wonders if the display of the above slogan these days would have served any purpose, if the pharmacognosists all over the world were not meted out a partisan and biased attitude by their pharmacy colleagues, which, as a consequence, forced them to re-claim for their discipline a place which is its due and which at the moment seems to be at the crossroads.

A reaction to the above-mentioned attitude has led to a change of names of pharmacognosy institutions in order to give them a more competitive look and respectability. Hence, one finds new names, like Institute of Pharmaceutical Biology and Pharmacognosy, Pharmazeutische Arzeimittellehre, Pharmacognosy and Analytical Phytochemistry, Pharmacognosy and Phytochemistry, Pharmaceutical Biology and Phytochemistry, etcetera.

The writer wishes to put to critical assessment his newly devised pharmacognosy course of reading and hopes that the pharmaceutical chemists would be prepared to make adjustments with their colleagues which would work for mutual understanding and augur well for pharmacy's future.

THE EVOLUTION OF PHARMACY COURSES AT THE UNIVERSITY OF SAO PAULO. **R. Wasicky**, Faculty of Pharmaceutical Sciences, University of Sao Paulo, Sao Paulo, Brazil.

The professional needs of pharmacy have changed during the past decade, and the courses offered at the Faculty increasingly tend to train professionals for work in pharmaceutical industries, food industries, and clinical and toxicological laboratories. What was until 1956 a three-year course of education passed to a four-year course in 1957 and to a five-year course in 1963. The original single course was changed in 1963 to a course with three options regarding subjects in the last semester, giving special emphasis to industrial pharmacy, food chemistry, and clinical analysis. In 1970, three definite options — industrial pharmacy, food technology, and clinical and toxicologic analysis — were introduced as from the sixth semester. Moreover, a shorter option for graduation of drug-store pharmacists within seven semesters was offered. This last course was abolished recently, and the three above-mentioned options now are offered as from the first semester.

The courses provide for ample training in all aspects of clinical laboratory analysis, in toxicological analysis, food technology, analysis and nutrition, and in pharmaceutical technology, industrial pharmacy, and pharmaceutical quality control.

## CONTRIBUTED PAPER SESSION TWO

### — Abstracts —

Presiding: **Charles F. Peterson, Ph.D.,** Professor of Pharmaceutics, Temple University, Philadelphia, Pennsylvania, U.S.A.

### IS THERE A PLACE FOR CLINICAL PHARMACY IN THE THIRD WORLD?

**E.H. Froese,** Department of Pharmacy, Faculty of Medicine, University of Zimbabwe, Salisbury, Zimbabwe.

Clinical pharmacy started in advanced countries, where there is a need for sophisticated pharmacy services. This advance came about because of the desire on the pharmacist's part to improve patient care, to be more involved with the patient, to experience greater job satisfaction, and to improve his own image. The concept is expensive, yet the greatest need for patient care improvement is in the emerging nations of the Third World.

In this paper, the current health care structure of Zimbabwe is described. The need for the technologist/technician is supported, and the possibility of a propharmacy is discussed. Financial figures are included to show where changes are needed to allow the improvement of health care for the whole of the population in a country. Areas of application and incorporation of the concepts of clinical pharmacy are described.

The pharmacy course at the University of Zimbabwe was started in 1974 and includes great clinical emphasis and involvement. The contributions which already have been made to the country by the graduates because of the training received have been encouraging and have proven that this type of education is relevant and feasible in this part of the world.

### PROBLEMS OF SCIENCE TEACHING AND RESEARCH IN NIGERIAN UNIVERSITIES WITH REFERENCE TO PHARMACY EDUCATION.

**P.G. Hugbo,** School of Pharmacy, University of Benin, Benin City, Nigeria.

Pre-independent Nigeria had only one University (Ibadan), which was closely tied to London University and offered courses mainly in the humanities and classics, with a spattering of basic sciences. Soon after 1960, more universities were established in response to the yearning for university places, with emphasis now shifting in favor of the applied sciences, particularly medicines, engineering, pharmacy and agriculture.

Four of the present 13 universities offer bachelor of pharmacy degree courses. Current admission into the schools of pharmacy is about 600, both direct and preliminary. Although these are modest figures compared with, say, Britain, they are significantly high when compared with the figures of from 10 to 15 years ago. Unfortunately, government has not matched this rise in need for higher science education with adequate resources to ensure fairly smooth management. Consequently, several constraints which have tended to decelerate the pace of academic progress have been identified. These are: poor financing; unreliable and frequently interrupted utility services; shortage of qualified personnel; and lack of motivation.

These and other remote factors will be discussed. All the same, some cautious optimism is expressed for the future, judging by the modest progress of the past.

ABOUT TEACHING THE BENZENE MOLECULE. **M. Khalifa,** Organic Chemistry Department, Faculty of Pharmacy, Cairo University, Cairo, Egypt.

To account for the stability of benzene in simple words, its heat of hydrogenation together with that of cyclohexene are used to calculate $\sigma:\pi$ ratio of the C-C benzene bond. Results revealed increase in the $\sigma$ character at the expense of the $\pi$ -character. This, besides accounting for the stability of benzene versus non-aromatic olefinic compounds, leads to data in excellent agreement with those reported:

| | Calculated | Reported |
|---|---|---|
| C-C bond length | 1.393 Å | 1.397 Å |
| C-C bond energy | 123.75 Kcal/mole | 123.80 Kcal/mole |
| S.E. of benzene molecule | 38.46 | 36 and 39.40 |

This is an example of a simplified approach to teaching organic chemistry to pharmacy students.

THE MAJOR STEPS IN IMPLEMENTING CONTINUING EDUCATION ACTIVITIES. **Werner Lowenthal,** School of Pharmacy, Medical College of Virginia/Virginia Commonwealth University, Richmond, Virginia, U.S.A.

The steps in planning, developing, implementing, and evaluating continuing education activities will be outlined. Methods to determine the needs of the clients is the first step. Writing the goals and objectives of the C.E. activity and the effect of the client characteristics constitute the second series of steps. The next cluster of steps involves planning the activity and determining the learning methods to be used. The fourth set of steps is the selecting of the activity site, the time, and inviting the instructors. Business management cluster of steps includes budget development, collecting learning materials, public relations, sending out announcements and beginning the fee collection. This is followed by on-site activities such as registration, handing out materials, and putting on the C.E. activity.

Evaluation of the participants and evaluation of the activity by the participants will be emphasized. The final series of steps includes collecting and paying the bills, doing a cost analysis and collecting all the statistical and evaluation data. This data becomes part of the base of the needs assessment for future activities and also a record of your performance. The steps in this procedure will be illustrated from current activities.

USE OF NON-MAMMALIAN SUBJECTS FOR PHARMACOLOGICAL RESEARCH. **V.O. Marquis,** Faculty of Pharmacy, University of Ife, Ile-Ife, Nigeria.

In view of the financial constraints experienced in the young universities developing in Nigeria and the desire to improve on the teaching and research in the Faculty of Pharmacy, the Department of Pharmacology had designed both for undergraduate teaching as well as research thorough investigations on the non-mammals that abound in our immediate environment in order to perform meaningful routine and critical appraisal of the basic studies on them. There is also the need to do comparative evaluations to see how these species of animals behave pharmacologically from the traditionally used mammals. Basic screening for primary investigations now can be carried out on these non-mammals which include the African rainbow lizard (*Agama agama*), the giant African snail (*achachatina maginata*), the land tortoise (*Kinixys crosa*) and the fruit eating bat (*Eidolon helvum*). The responses of the tissues of these animals to drugs such as histamine, 4HT, Ach and electrical stimulation will be presented. The features of the actions of such drugs and other parameters will be commented upon.

### CONTINUING EDUCATION FOR INDUSTRIAL PHARMACISTS IN THE 1980s.

**Keith Marshall,** Institute for Applied Pharmaceutical Sciences, East Brunswick, New Jersey, U.S.A.

The industry is experiencing difficulty in recruiting knowledgeable graduates and is resorting to more "in-post" training. Rapidly advancing technology necessitates frequent exposure of the experienced scientist to updating exercises. Demand for accreditation programs is increasing. Continuing education organizations (CEO) specializing in these multiple needs should satisfy the following criteria: (1) offer pragmatic training directly related to daily work; (2) instructors are practicing professionals capable of fulfilling '1' concisely and effectively; (3) program format fits needs of participants/employers in terms of time and venue; and (4) possess resources to operate on an industry-wide basis.

These criteria indicate a CEO significantly different from traditional educational establishments because: (1) principle objective here is knowledge for its own sake, not a degree — industry (not the CEO) sets standards; (2) CEO must have access to a large number of practicing specialists in widely diverse fields; (3) considerable financial commitment is required not only for faculty but for promotional and support functions; (4) an independent, impartial review mechanism to maintain standards is required.

These points will be elaborated to show that an expanded and improved spectrum of continuing educational programs dedicated to the needs of the 1980s will be provided largely by non-collegiate CEOs. This rationale is also translatable to the international community.

### THE ROLE OF THE PHARMACIST IN THE PUBLIC DRUG ABUSE EDUCATION.

**J.E. Murad** and **T. Myrtes Murad,** Pharmacy School, Federal University of Minas Gerais, Belo Horizonte, Brazil.

Among the roles of the pharmacist nowadays, public drug abuse education is one of the most important. The "hard drugs" like morphine and heroine are not yet a problem of abuse in Brazil. The illegal drugs like marijuana, cocaine and LSD are problems related mostly with the police systems. Nevertheless, because of the difficulties of obtaining those drugs or the amphetamines, the Brazilian users are turning to drugs that are easily obtained in the pharmaceutical commerce through the normal trade or false prescriptions. Among many examples, it is possible to quote: the trihexyphenidyl (Artane*), methaqualone (Mandrix*), dextropropoxyphene (Algafan*), and some association like Optalidon* (aminophenazone +

butabarbital + caffeine). In those cases, the role of the pharmacist is a very important one. In our education programs, pharmacists are oriented in the following way: a) never to sell those drugs to the underaged; b) not to sell more than one or two bottles and five ampoles each time; c) to be very careful about prescriptions, which often are false.

Nevertheless, 80 percent of the pharmacies in Brazil belong to lay people. It is necessary to call the attention of our pharmacy students to the fact that now, more than ever, it is necessary to have a pharmacist at the head of our pharmacies.

## THE EVOLUTION OF THE SANDWICH PHARMACY COURSE AT THE UNIVERSITY OF BENIN, NIGERIA.

**Bona Obiorah**, School of Pharmacy, University of Benin, Benin City, Nigeria.

The University of Benin has offered a sandwich pharmacy program since October 1971, when the first batch of pharmacy students were admitted to the University. At its inception, the pharmacy course was designated to last for five years, including one pre-degree year. The University of Benin remains the only university in Nigeria offering a sandwich course for the pharmacy degree.

The program is designed in such a way that the student spends a full year in the school and then proceeds on an industrial attachment which lasts from July to December (6 months). The student returns to the school in January and remains there until the end of June, when he or she again proceeds to another period of 6 months of industrial attachment. There is no industrial attachment in the penultimate year. This means that during the pharmacy course, the student spends a total of one year in industrial establishments.

We in Benin have found this program worthwhile. Some schools of pharmacy in Nigeria are in the process of revising their curriculum, and some have indicated that they will adopt a sandwich course fashioned after the Benin experiment. Even here in Benin, our curriculum is being revised to include such matters of great interest as clinical pharmacy and pharmacokinetics.

## TEACHING STEREOCHEMISTRY THROUGH STEREOMODELS — USE WORKSHOP.

**Harkishan Singh** and **Vijay K. Kapoor**, Department of Pharmaceutical Sciences, Panjab University, Chandigarh, India.

A good comprehension of the stereochemistry of drug molecules is a must for a student of medicinal and pharmaceutical chemistry. The three-dimensional details may provide information about the drug-receptor interactions and receptor characteristics. The understanding of conformational and configurational perspectives by the student can be made more meaningful and impressive through a workshop where the students look at stereochemical features using the models with their own hands. For the last some years, we have used this approach, which has helped in inculcating inquisitiveness among the students, and they have developed a greater appreciation and grasp of the subject. The workshop is conducted in small groups of students, and they are provided atom models kits as ball and stick type, framework molecular sets, Fisher-Hirschfelder atom models, and Dreiding models. Selected exercises in stereochemistry are given from the area of medicinal chemistry.

The experience about the conduct of the workshop which we have gained and the nature of the exercises are worth sharing with other teachers of medicinal and pharmaceutical chemistry.

## TEACHING OF MEDICINAL CHEMISTRY AT THE UNDERGRADUATE LEVEL. **H.P. Tipnis,** The Bombay College of Pharmacy, Bombay, India.

Medicinal chemistry plays a very important role in the modern pharmacy, and it requires the development of a suitable teaching program for the students at the undergraduate level. In India, the curriculum of most universities includes the fundamental aspects of this subject only in the final year of the bachelor's degree, and it has been found that the curriculum does not provide the needs of the pharmaceutical industry or research and development.

In order to teach this subject more effectively, it is suggested that the student should be made aware of recent progresses and applications of drug development, drug delivery, instrumental methods of analysis, etc. It is recommended that many similar other aspects are taught during the entire tenure of the degree course with uniform spread over of relevant topics. Teaching of detailed methodology or random approach must be avoided. The student performance should be assessed periodically with laboratory exercises.

## CONTRIBUTED PAPER SESSION TWO

— Abstracts —

Presiding: **Sumner Robinson, Ph.D.**, Dean, Massachusetts College of Pharmacy and Allied Health Sciences, Boston, Massachusetts, U.S.A.

PHARMACEUTICAL EDUCATION AND THE CONJOINT PROGRAM. **A.A. Ageel, A.A. Al-Badr** and **A.C. Ellison**, Riyad University College of Pharmacy, Riyad, Saudi Arabia.

The aim of this paper is to examine the present pathway of pharmaceutical education and to explore alternative routes to make the pharmacist a more vital member of the health care team. Several alternatives to the present educational system will be presented, including:

Expanding the Conjoint Program from its present one-year structure to two years, with the second year containing the biomedical subjects essential to the health care team.

The expansion and implementation of a continuous education program to bring the pharmacist and local health care members up-to-date on new drugs and methods. The present pathway also will be mentioned.

Selection of the allied medical college before joining the Conjoint Program.

Finally, the Conjoint Program and its relationship to the allied medical schools will be discussed, since it plays a key role in the eventual selection of a student to the College of Medicine, Pharmacy or Dentistry, or allied medical sciences.

PHARMACY EDUCATION IN MALAYSIA. **Ee-Kiang Gan** and **Musa Bin Mohamad**, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Minden, Penang, Malaysia.

The first school of pharmaceutical sciences in Malaysia, a country with a population of approximately 13 million people, was established in 1972 at Universiti Sains Malaysia in the island state of Penang. It is still the only school of pharmacy in the country, offering a four-year undergraduate course leading to a degree of Bachelor of Pharmacy with Honors. Adequate preparation was given to students upon entry into year one of study, during which chemistry, biology and mathematics were taught.

The professional component of the program is divided into five disciplines: pharmaceutical chemistry; pharmaceutical technology; physiology; pharmacology; and clinical pharmacy. Courses in pharmaceutical chemistry are devoted mainly to medicinal chemistry and pharmaceutical analysis, with some emphasis on natural product chemistry. Pharmaceutical technology concentrates mainly on product development, in-patient quality control, and patient counseling with respect to dispensed products. The biological component in the curriculum is taught through physiology and pharmacology that eventually extends into clinical pharmacy, enabling students to appreciate the relationship of drug usage to disease states and patient management.

In addition to these professional disciplines, the curriculum includes a sprinkling of electives in management, social sciences and humanities, as well as a one-seminar course offering in forensic pharmacy.

POSSIBLE FUTURE TRENDS IN PHARMACY EDUCATION IN NIGERIA. **E.O. Ogunlana,** Faculty of Pharmacy, University of Ife, Ile-Ife, Nigeria.

Pharmaceutical services have to change with the new focus on basic health care delivery system as well as the implementation of a definite and dynamic national drug policy. Generally, changes in services delivered must cause changes in education in order not to cause deficiencies in the services.

The team concept among workers in health care also is gaining ground slowly; hence, the pharmacist must fill his or her place fully within the system.

The development of appropriate communication skills in order to provide for the interpretative and advisory role calls for more knowledge of sociology and the dynamics of communication. More product knowledge must be developed into the curriculum.

The move toward drug manufacture and quality control within public institutions also places more emphasis on industrial pharmacy as well as hospital ward involvement in order to monitor drug use as well.

The education of patients at the primary care level also may rest on the pharmacist in order to pursue effective health education; pharmacy students may find themselves being taught how to teach pharmaceutical aids and consumers of health services.

CURRICULAR REVISION AT RHODES UNIVERSITY. **E. Ramstad** and **B.J. Wilson,** Faculty of Pharmacy, Rhodes University, Grahamstown, Republic of South Africa.

The raison d'etre of any profession is to fulfill an existing social need by the application of that profession's unique abilities, and the theoretical and practical training must be designed to provide students with these abilities. With this premise before us, it was necessary to: (1) analyze the various functions of the pharmacist; (2) analyze the minimum knowledge and skill required to meet the smallest units of these functions; (3) structure this knowledge into subject areas; and (4) correlate the areas for didactic purposes.

In South Africa, as in probably most of the world, neither the pharmacy board, nor society, nor indeed pharmacy itself has provided a clear definition or delineation of the extent and limits of our profession. Our first step was, therefore, to question other members of the professions about what the pharmacist is expected to do for them and our own practitioners what their work actually entails.

From that point, a curriculum was developed to cover the three years of the student's professional training. The developmental process started from a realistic and detailed picture of the skills, knowledge and attitudinal needs of the graduate and evolved stepwise in the reverse direction through the years, from the fourth to the third, to the second, to the first year of the student's program. This approach will ensure that an adequate foundation at the proper time will be laid for all facets of the curriculum, since all needs had been specified.

The result is a unique program. The approach taken at Rhodes may provide useful methodology for other pharmacy curricular designers.

## DRUG MONITORING — AN ESSENTIAL ASPECT OF FUTURE PHARMACY EDUCATION IN GHANA. **Arthur C. Sackeyfio**, Department of Pharmacology, Faculty of Pharmacy, University of Science and Technology, Kumasi, Ghana.

Current drug monitoring in Ghana is confined to routine cataloging of imported drugs and control of manufacturing processes in the drug industry. This is followed up with a distributive program which is controlled by pharmaceutical legislation. Government agencies for drug surveillance are the Pharmacy Board and the Standards Board, which are respectively responsible for ensuring good pharmacy practice and maintenance of acceptable standards of drug quality. However, drugs and poisons information service, quality assurance units in hospitals, and clinical pharmacy practice are lacking. Pharmacy education for the future pharmacist must, therefore, prepare the student for full participation in these aspects of drug monitoring. The course structure should ensure a clear understanding of the patient's reaction to drugs. Information centers for drugs and poisons are urgently needed to guide both medical and lay personnel in the correct usage of drugs. Relevant aspects of toxicology and pharmacology should be incorporated into the undergraduate program. Pharmacokinetics, pharmacodynamics, and bioavailability studies should be encouraged to ensure a practical participation of clinical pharmacists in the proper management of patients. Instrumentation and analytical techniques should be added to augment the ability of the pharmacist to undertake quality assessment of drugs, particularly in our tropical environment.

## TRAINING IN GERIATRIC MEDICATION USE FOR NON-PHARMACIST GERONTOLOGISTS. **William Simonson** and **Clara Collette-Pratt**, School of Pharmacy, Oregon State University, Corvallis, Oregon, U.S.A.

The training of professionals who are working in the many various areas of gerontology does not generally consist of formalized coureswork dealing with the significance of medication effect and potential problems in the elderly.

Since medication is consumed by many elderly persons, it is important that professionals who are working in gerontology have an awareness of the effect and potential problems that medication can exhibit in this age group.

Through the coordinated efforts of the Oregon State University School of Pharmacy, the Program on Gerontology at Oregon State University, and the U.S. Bureau of Health Manpower, an interdisciplinary university level course has been developed to sensitize students of various professions to the broad but important issue of drug use in the elderly.

The course, which will be reviewed in this presentation, includes information concerning the basic pharmacology of common prescription and non-prescription medications, the incidence and significance of drug induced disease in the elderly, improper compliance to prescribed drug therapy by elderly persons, the use of "child proof" medication containers by the elderly, and more.

Presently, most gerontological professionals do not have formalized training in the area of medication use. An interdisciplinary university level course has been developed to provide these professionals with sufficient knowledge of medication use and misuse by the elderly.

### ACPE CONTINUING EDUCATION PROVIDER APPROVAL PROGRAM. **Roxie R. Smith**, American Council on Pharmaceutical Education, Chicago, Illinois, U.S.A.

Participation in continuing pharmaceutical education is currently required as a prerequisite to relicensure in 21 of the 50 states. To aid pharmacists in selecting and state pharmacy boards in accepting credit for continuing education programs, the Council has developed a process to assure the presence of quality programming.

Through initial evaluation, as well as ongoing review and monitoring activities, each provider's capacity to develop and present quality continuing pharmaceutical education in accordance with the requirements of the Criteria for Quality is assessed. Recommendations for strengthening are provided regularly.

Recognizing that continuing pharmaceutical education is a relatively young endeavor, the Council seeks to provide the assistance which will result in the collective improvement of the profession. Through symposia materials and information exchange and other forms of technical assistance, strengthening of providers' capacities is sought. As a result of these efforts, both qualitative and quantitative gains have been made.

### CATALYST FOR PROGRESS: THE SCHOOL OF PHARMACY IN ZIMBABWE. **R.S. Summers**, Department of Pharmacy, Faculty of Medicine, University of Zimbabwe, Salisbury, Zimbabwe.

The development of the School of Pharmacy in Zimbabwe (Rhodesia) since its inauguration in 1974 is examined against a background of limited resources and economic sanctions.

The results of the phenomenon whereby all of Zimbabwe's pharmacists prior to 1974 were trained elsewhere are presented and discussed. The deliberate placing of the School of Pharmacy in the Faculty of Medicine at its inception brought numerous advantages and resulted in high educational standards, as well as providing an important opportunity to bring clinical pharmacy to the Third World.

The school's current activities, its effects on and contributions to the health services and the pharmaceutical profession have so far been concentrated in the areas of manpower, continuing education, research into local problems, and a drug and toxicology information service.

Improvements in community and hospital pharmacy practice have been achieved. It is evident that the school has functioned as a catalyst for progress, although much remains to be done. Objectives are described. The school needs to develop to meet the particular challenge of bringing "pharmacy in the 80s" to a small developing country that is experiencing rapidly changing circumstances.

### HOW TO TRAIN A PHARMACIST IN A THREE-YEAR PROGRAM. **Geoffrey N. Vaughan**, Victorian College of Pharmacy, Parkville, Victoria, Australia.

The Victorian College of Pharmacy (Melbourne, Australia) is the first school outside the U.S.A. to participate in the Pharmat Basic Pharmaceutical Sciences Examination. The results of the examination have been more than favorable, and the college ranks highly when compared with American schools.

This has been an interesting experiment, as all pharmacy programs in Australia are of three years' duration, during which time the students undertake their basic science studies and their professional courses, compared with the five and six year programs in the United States.

A general outline of the Melbourne course will be given in an attempt to compare it with the American system and to show that competent pharmacists can graduate from such a system.

Several Australian courses have attempted to expand to four year programs but have been prevented from doing so by government policy. The history of government control of tertiary education in Australia will be discussed.

# LIST OF PARTICIPANTS

Prof. A.A. Abou-Ouf
60 Mathaf E. Manyal
Street
Cairo
Egypt

A.M. Ageel, Ph.D.
Drug and Poison
Information Center
College of Pharmacy
University of Riyadh
Riyadh, Saudi Arabia

Edward C. Agulanna
Chris Chemists Ltd.
P.O. Box 173
Enugu
Nigeria

Dr. C.N. Aguwa
Faculty of Pharmaceutical Sciences
University of Nigeria
Nsukka
Nigeria

Prof. P. Iwe. Akubue
Faculty of Pharmaceutical Sciences
University of Nigeria
Nsukka
Nigeria

Abdullah A. Al-Badr,
Ph.D.
Dean
College of Pharmacy
University of Riyadh
Riyadh, Saudi Arabia

Prof. Dr. Mohammad
Amin, Dean
Faculty of Pharmacy
University of the Punjab
Lahore, Pakistan

Benjamin Ansah
300 Brookline Avenue
P.O. Box
Boston, MA 02115
U.S.A.

Albert Awad, Ph.D.
Prof. of Pharmacognosy
Dept. of Pharmacology
College of Pharmacy
Ohio Northern Univ.
Ada, OH 45810 U.S.A.

Prof. Dr. Shafik Balbaa
5 Ibn El-Azad Street
Giza
Egypt

Dr. J.N. Banerjee
Sandoz India, Ltd.
Worli
Bombay - 18
India

Judith Barr, Ast. Dean
Northeastern University
206 MU
Boston, MA 02115
U.S.A.

M. Bast-Huls
4038 Clairmont Avenue
Birmingham, AL 35222
U.S.A.

Ross. M. Baxter, Dean
Faculty of Pharmacy
University of Toronto
Toronto, Ontario
Canada M5S 1A1

H.N. Bhargava, Ph.D.
Massachusetts College
of Pharmacy
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Mr. A. Beeke
Food and Drug Administration
585 Commercial St.
Boston, MA 02109
U.S.A.

K. Boakye-Yiadom,
Ph.D.
Faculty of Pharmacy
U. Science & Tech.
Kumasi, Ghana
West Africa

Mitchell L. Borke,
Ph.D.
School of Pharmacy
Duquesne University
Pittsburgh, PA 15219
U.S.A.

Dr. Colin J. Briggs
Faculty of Pharmacy
Univ. of Manitoba
Winnipeg, Manitoba
Canada R3T 2N2

Dr. Donald C. Brodie
U. Southern Calif.
School of Pharmacy
Los Angeles, CA
90033 U.S.A.

Chris V. Cavey
Pharmacy International
Elsevier/N. Holland Biomedical Press
14A Regent St., Cambridge
CB2 1DB, U.K.

## PARTICIPANTS
— continued —

Hsüch-ching Chiang, Ph.D.
Prof. of Pharmacognosy
School of Pharmacy
Nat'l. Taiwan Universtiy
No.1, 1st Sec., Jen-li Road
Taipei, Taiwan, R.O.C.

Cecilia Claesson
Dept. of Social Pharmacy
University of Uppsala
BMC, Box 586
S-751 23 Uppsala
Sweden

Dr. George H. Cocolas
School of Pharmacy
Univ. of North Carolina
Beard Hall 200H
Chapel Hill, NC 27514
U.S.A.

Criselides Rocha Coppoli
College of Pharmacy
Ouro Preto
Rua Costa Sena 2
Brazil

Joseph L. Daly
27 Union Street
Lawrence, MA 01840
U.S.A.

Professor P.F. D'Arcy
Department of Pharmacy
Queen's Univ. of Belfast
Lisburn Road
Belfast BT9 7BL
Northern Ireland, U.K.

Anohé Defalque
8 Avenue Geo. Bernier
1.050 Brussels
Belgium

Robert D. Deforge
Dept. of Cooperative
Education
Northeastern University
360 Huntington Avenue
Boston, MA 02115 U.S.A.

Dr. Yehia Dessouky
University of Tripoli
El Fateh
P.O. Box 4022
Tripoli, Libya

Prof. Dr. Liliana Drenovska-Noninska
ul. Duñav, No. 1
Sofia 1000
Bulgaria

Sr. Jane M. Durgin, Ed.D.
Ast. Dean for Curriculum
St. John's University
College of Pharmacy
Jamaica, NY 11439 U.S.A.

Prof. Mohamed A. Eldawy
Chm., Dept. of Med. Chem.
Dean, Faculty of Pharmacy
University of Tanta
Tanta, Egypt

Prof. Dr. M.A. El-Gendy
Faculty of Pharmacy
University of Assiut
Assiut, Egypt

Prof.Dr. A.M. El-Moghazy
Vice President
Assiut University
Assiut
Egypt

Dr. Glen E. Farr
College of Pharmacy
Univ. of Tennessee
874 Union Avenue
Memphis, TN 38163
U.S.A.

Jamal Lathihitaraf
300 Brookline Avenue
P.O. Box 780
Boston, MA 02115
U.S.A.

Donald O. Fedder
School of Pharmacy
Univ. of Maryland
636 W. Lombard St.
Baltimore, MD 21201
U.S.A.

Nicholas I.Y. Fiagbe
Faculty of Pharmacy
Univ. of Science
& Technology
Kumasi, Ghana
West Africa

Julian H. Fincher, Dean
College of Pharmacy
Univ. of South Carolina
Columbia, SC 29208
U.S.A.

Harry C. Foster, Mgr.
Pharmacy Affairs
Geigy Pharmaceuticals
556 Morris Avenue
Summit, NJ 07901
U.S.A.

Dr. William O. Foye
Massachusetts College
of Pharmacy
179 Longwood Avenue
Boston, MA 02115 U.S.A.

## PARTICIPANTS
— continued —

E.H. Froese, Pharm.D.
University of Zimbabwe
Box MP 167
Mt. Pleasant
Salisbury, Zimbabwe

Ee-Kiang Gan, Ph.D., Dean
School of Pharmaceutical
Sciences
Univ. Sains Malaysia
Minden, Penang
Malaysia

Dr. R.J. Gerraughty
School of Pharmacy
Creighton University
2500 California Street
Omaha, NE 68173 U.S.A.

Dr. Abdelrahim M. Ghazal
Prof. of Pharmacology
Faculty of Pharmacy
Alexandria University
Alexandria, Egypt

Dr. Melvin Gibson
Washington State Univ.
College of Pharmacy
Pullman, WA 99164
U.S.A.

Dr. Robert Gibson
Univ. of California
School of Pharmacy
San Francisco, CA 94143
U.S.A.

Dr. Anton P. Goossens
Dept. of Pharmaceutics
Potchefstroom University
Potchefstroom
South Africa

Dr. Raymond Gosselin
Massachusetts College of
Pharmacy
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Martha A. Gray
67 1/2 Hillside Street
Roxbury Crossing
Massachusetts 02120
U.S.A.

Steven L. Grossman
75 St. Alphonsus Street
#109
Boston, MA 02120
U.S.A.

Dr. Abraham J. Haddad
Dean, Hampden Campus
MA College of Pharmacy
24 Bellamy Road
Springfield, MA 01119
U.S.A.

Dr. Muwaffak Haddadin
Director
School of Pharmacy
Yarmouk University
Liaison Office
Amman, Jordan

Dr. Marilyn Harris
School of Pharmacy
Duquesne University
Pittsburgh, PA 15219
U.S.A.

Mr. Bryan Hartley
Room 710, D.H.S.S.
Hannibal House
Elephant and Castle
London, U.K.

Dr. A.G. Hartzema
College of Pharmacy
University of Minnesota
Minneapolis, MN 55455
U.S.A.

Prof. Dr. F.M. Hashem
Dean, Fac. of Pharmacy
Kasr El-Eni Street
Cairo University
Cairo, Egypt

William M. Heller, Ph.D.
U.S.P.
12601 Twinbrook Pkwy.
Rockville, MD 20852
U.S.A.

Dr. Erick Herfindal
Univ. of California,
San Francisco
School of Pharmacy
San Francisco, CA 94143
U.S.A.

Benjamin Hershenson
MA College of Pharmacy
& Allied Health Sci.
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Prof. Dr. Sayed H. Hilal
Vice Dean
Faculty of Pharmacy
Kasr El-Ainy
Cairo, Egypt

Dr. Wendell Hill
College of Pharmacy
Howard University
2300 4th Street N.W.
Wash., DC 20059 U.S.A.

## PARTICIPANTS
— continued —

Raymond E. Hopponen
College of Pharmacy
South Dakota State Univ.
Brookings, SD 57007
U.S.A.

Dr. Weng F. Huang
School of Pharmacy
Nat'l. Taiwan University
1 Jen-Ai Rd. Set. 1
Taipel, Taiwan (100)
Republic of China

Dr. Peter G. Hugbo
School of Pharmacy
University of Benin
Benin City
Nigeria

El-Sebai A. Ibrahim
Vice Dean and Prof. of
P'ceutical Chemistry
Faculty of Pharmacy
Alexandria, Egypt

Dr. O. James Inashima
Northeastern University
College of Pharmacy
& Allied Health Prof.
360 Huntington Avenue
Boston, MA 02115 U.S.A.

Dr. Samira Islam
King Abdul Aziz Univ.
Faculty of Medicine
and Allied Sciences
Jedda, Saudi Arabia

Raymond Jang
School of Pharmacy
U. of North Carolina
Chapel Hill, NC 27514
U.S.A.

Ayoade Joko (Mrs.)
ABC Chemist
P.O. Box 3402 MAPO
Ibadan, Nigeria

Dr. Vijay K. Kapoor
Dept. of Pharmaceutical
Sciences
Panjab University
Chandigarh 160014
India

Jan Karlsen
Dept. of Pharmaceutics
Institute of Pharmacy
University of Oslo
Norway

Dr. Chikataro Kawasaki.
12-3 A 304 Fukakusa
Shokakucho, Fushimiku
Kyoto, 612
Japan

Dr. Douglas H. Kay
Massachusetts College
of Pharmacy and
Allied Health Sci.
179 Longwood Avenue
Boston, MA 02115 U.S.A.

Prof. Dr. M. Khalifa
Faculty of Pharmacy
Kasr El-Aini Street
Cairo, Egypt A.R.E.

Dr. Afaf Aboul Kheir
Dean, Faculty of Pharmacy
Zagazig University
Zagazig
Egypt

Dr. Ronald Kluza
College of Pharmacy
Univ. of Arkansas
4301 W. Markham St.
Little Rock, AR 72201
U.S.A.

Dr. H. Kofod
Royal School of
Pharmacy
2, Universitetsparken
DK-2100 Copenhagen Ø
Denmark

Dr. Jörg Kreuter
Pharmazeutisches
Institut ETH
Clausiusstr. 25
CH-8092 Zurich
Switzerland

Janet A. Krieger
Librarian
College of Pharmacy
Univ. of Minnesota
Minneapolis, MN 55455
U.S.A.

Dr. J. Lach
University of Iowa
College of Pharmacy
Iowa City, IA 52242
U.S.A.

Stuart M. Lane, Ph.D.
Smith Kline & French
Laboratories
1141 W. Laurelton Pkwy.
Teaneck, NJ 07666
U.S.A.

Edward F. LaSala
Professor of Chemistry
MA College of Pharmacy
179 Longwood Avenue
Boston, MA 02115 U.S.A.

## PARTICIPANTS
### — continued —

Dr. Paul Laskar
School of Pharmacy
Oregon State University
Corvallis, OR 97331
U.S.A.

John D. Leary
Massachusetts College
of Pharmacy
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Professor M. Lesne
Catholic U. of Louvain
UCL 7350
Avenue Mounier, 73
B-1200 Bruxelles
Belgium

Dr. C.T. Lesshafft, Jr.
Assoc. Dean for Instruction
University of Kentucky
College of Pharmacy
Lexington, KY 40506
U.S.A.

Hans H. Linden
Director
Apotekarsocieten
P.O. Box 1136
S-111 81 Stockholm
Sweden

Arthur G. Lipman, Pharm.D.
College of Pharmacy
University of Utah
Salt Lake City, UT 84112
U.S.A.

Prof. R.H. Lombard
School of Pharmacy
University of the North
Pietersburg 0700
South Africa

Dr. Werner Lowenthal
Virginia Commonwealth
University
School of Pharmacy
Richmond, VA 23298
U.S.A.

Dr. Sheng-Teh Lu
School of Pharmacy
Kaohsiung Medical College
281 Chong-Hsiaw 1st Road
Sing-Hsing District
Kaohsiung, Taiwan R.O.C.

Dr. William Lubawy
Univ. of Kentucky
College of Pharmacy
Lexington, KY 40506
U.S.A.

Gavin K. MacHutchin
Massachusetts College
of Pharmacy & Allied
Health Sciences
179 Longwood Avenue
Boston, MA 02115 U.S.A.

Prof.Dr.Dr. G. H. Mahran
Head, Pharmacognosy Dept.
Faculty of Pharmacy
Kasr el Aini
Cairo University
Cairo, Egypt

Jacqueline Maio
The Property Assn.
1700 Pennsylvania Ave. N.W.
Washington, D.C. 20006
U.S.A.

Dr. V.O. Marquis
Faculty of Pharmacy
University of Ife
Ile-Ife
Nigeria

Keith Marshall, Director
Institute for Applied
P'ceutical Sciences
P.O. Box H
E. Brunswick, NJ 08816
U.S.A.

Bruce D. Martin
Dean
School of Pharmacy
Duquesne University
Pittsburgh, PA 15219
U.S.A.

Louis Martinelli, Dean
School of Pharmacy
University of the Pacific
Stockton, CA 95211
U.S.A.

Dr. Nouri Y. Mary
Arnold & Marie Schwartz
College of Pharmacy
75 DeKalb Avenue
Brooklyn, NY 11201
U.S.A.

George Matelli
Massachusetts College of
Pharmacy and Allied
Health Sciences
179 Longwood Avenue
Boston, MA 02115 U.S.A.

Dr. Ian Mathison, Dean
Ferris State College
School of Pharmacy
Big Rapids, MI 49307
U.S.A.

Dr. Alice Jean Matuszak
School of Pharmacy
University of the Pacific
Stockton, CA 95211
U.S.A.

## PARTICIPANTS
— continued —

Dusica Maysinger, Ph.D.
Faculty of Pharmacy
University of Zagreb
41 000 Zagreb
A. Kovacica I
Yugoslavia

Dr. Joseph McEvilla
Temple University
School of Pharmacy
3307 N. Broad Street
Philadelphia, PA 19140
U.S.A.

Dr. E. Menczel
School of Pharmacy &
Ministry of Health
Pharmaceutical Division
Jerusalem, Israel

James Mickles
Massachusetts College
of Pharmacy
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Michael Montagne
College of Pharmacy
University of Kentucky
Lexington, KY 40506
U.S.A.

Dr. Abdel-Fattah A. Moussa
Central Medical Labs of
the Egyptian Army
13 Mohammed Pasha Ryad
Heliopolis
Cairo, Egypt

Dr. Robert Mrtek
College of Pharmacy
University of Illinois
P.O. Box 6998
Chicago, IL 60680 U.S.A.

Prof. José Elias Murad
Dean
School of Pharmacy
Av. Olegário Maciel, 2360
30,000 Belo Horizonte
Brazil

Mr. Leon Naudé
Dept. of Pharmacology
Univ. of Potchefstroom
Potchefstroom 2520
Rep. of South Africa

Roseland Ntege
35 Wigglesworth St.
Boston, MA 02120
U.S.A.

Prof. Bona Obiorah
Dept. of Pharmaceutics
School of Pharmacy
University of Benin
Benin City
Nigeria

Dr. John Ocran
Faculty of Pharmacy
University of Science
and Technology
Kumasi, Ghana

Mr. Liuinus A. Ofoleta
133 Peterborough St.
Apt. 25
Boston, MA 02215
U.S.A.

Prof. E.O. Ogunlana
Faculty of Pharmacy
University of Ife
Ile-Ife
Nigeria

Prof. D.T. Okpako
Dept. of Pharmacology
and Therapeutics
University of Ibadan
Ibadan, Nigeria

Jun Okuda
Dept. of Clinical
Biochemistry
Faculty of Pharmacy
Meijo University
Nagoya 468 Japan

Professor P.A. Parish
The Welsh School of
Pharmacy
U.W.I.S.T.
Cardiff CF1 3NU
United Kingdom

William A. Parker
College of Pharmacy
Dalhousie University
Halifax, Nova Scotia
Canada B3H 3J5

Mr. Alan Phair
National Wholesale
Druggists Assn.
66 Broadway, Rt. 1
Lynnfield, MA
U.S.A.

Richard P. Penna
American Pharmaceutical Assn.
2215 Constitution Ave.
Washington, DC 20037
U.S.A.

Dr. Charles Peterson
School of Pharmacy
Temple University
Philadelphia, PA 19140
U.S.A.

## PARTICIPANTS
**— continued —**

Ms. Patricia Piermatti
Library of Sci. & Med.
Rutgers University
P.O. Box 1029
Piscataway, NJ 08854
U.S.A.

William F. Pillow, Jr.
Eli Lilly & Company
Professional Relations
307 E. McCarty Street
Indianapolis, IN 46285
U.S.A.

Prof. Maria Aparecida
Pourchet-Campos
Reitoria da Unesp
Praca Da Sé, 108, 6º andar
São Paulo, SP
Brazil

Charles Pulliam
117-A Beard Hall
School of Pharmacy
Univ. of North Carolina
Chapel Hill, NC 27514
U.S.A.

Robert F. Raffauf
College of Pharmacy &
Allied Health Prof.
Northeastern University
Boston, MA 02115
U.S.A.

Max D. Ray, Director
Accreditation Services
ASHP
4630 Montgomery Avenue
Bethesda, MD 20014
U.S.A.

James A. Riesgraf, R.Ph.
Pharmacy & Trade Rel.
The Upjohn Company
Kalamazoo, MI 49001
U.S.A.

Juan R. Robayo, Pharm.D.
College of Pharmacy
Univ. of Oklahoma
Oklahoma City, OK 73190
U.S.A.

Sumner Robinson, Dean
Massachusetts College
of Pharmacy
179 Longwood Avenue
Boston, MA 02115
U.S.A.

David B. Roll
Prof., Med. Chemistry
College of Pharmacy
University of Utah
Salt Lake City, UT 84112
U.S.A.

John S. Ruggiero, Ph.D.
Pharmaceutical Manufacturers Assn.
1155 15th St. N.W.
Washington, DC 20005
U.S.A.

Arthur C. Sackeyfio, Ph.D.
Dept. of Pharmacology
Faculty of Pharmacy
Univ. of Science and
Technology
Kumasi, Ghana

Eriko Sato
25 St. Mary's Court
Brookline, MA 02146
U.S.A.

Fred Schneiweiss
Northeastern University
Room 113 MU
360 Huntington Avenue
Boston, MA 02115 U.S.A.

Gerald Schumacher, Dean
Northeastern University
College of Pharmacy
& Allied Health Prof.
179 Longwood Avenue
Boston, MA 02115 U.S.A.

Dr. Michael A. Schwartz
College of Pharmacy
University of Florida
Box J-4
Gainesville, FL 32610

John J. Sciarra, Dean
Arnold & Marie Schwartz
College of Pharmacy
& Health Sciences
75 DeKalb Avenue
Brooklyn, NY 11201 U.S.A.

Prof. H.I. Silverman
Massachusetts College
of Pharmacy
179 Longwood Avenue
Boston, MA 02115
U.S.A.

William Simonson, Pharm.D.
School of Pharmacy
Oregon State Universtiy
Corvallis, OR 97331
U.S.A.

Dr. Fauzi Sjuib
College of Pharmacy
Bandung Inst. of Tech.
10 Ganeca Street
Bandung, Indonesia

Robert V. Smith, Ph.D.
Drug Dynamics Inst.
College of Pharmacy
Univ. of Texas, Austin
Austin, TX 78712 U.S.A.

## PARTICIPANTS
**— continued —**

Roxie R. Smith
American Council on Pharmaceutical Education
Suite 2210
One E. Wacker Drive
Chicago, IL 60601 U.S.A.

Prof. José Coppoli Sobrinito
Rua Farmaceutico Antonio V. Brito, 4
Ouro Preto-Mg
Brazil

CPT D.A. Solimando, Jr., MSC
OSC Box 591
Walter Reed Army Medical Center
Wash., DC 20012 U.S.A.

Albert H. Soloway, Dean
College of Pharmacy
Ohio State University
Columbus, OH 43210
U.S.A.

Prof. Paul S.J. Spencer
Dean
Welsh School of Pharmacy
U.W.I.S.T.
Cardiff, CF1 3NU
U.K.

Barbara Stewart, M.Phil.
Dept. of Pharmacy
University of Aston
Gosta Green
Birmingham B47ET
Great Britain

Douglas J. Stewart
Faculty of Pharmacy
University of Toronto
Toronto, Ontario
Canada

Mitchell J. Stoklosa
86 Mayflower Road
Needham, MA 02192
U.S.A.

Professor Rob Summers
Department of Pharmacy
Univ. of Zimbabwe
P.O. Box 167
Mount Pleasant
Salisbury, Zimbabwe

Dr. Stanley V. Susina
Samford University
800 Lakeshore Dr.
Birmingham, AL 35229
U.S.A.

Joseph V. Swintosky
College of Pharmacy
Univ. of Kentucky
Lexington, KY 40506
U.S.A.

Albert H. Taubman
Northeastern University College of Pharmacy
360 Huntington Avenue
Boston, MA 02115
U.S.A.

Vasant G. Telang, Ph.D.
College of Pharmacy
Howard University
Washington, DC 20059
U.S.A.

S.V. Thambiah, M.Sc.
29 Egerton Road
London N16
U.K.

John T. Tighe, III
Asst. to the Executive Vice Pres.
NARD
1750 K Street N.W.
Wash., DC 20006 U.S.A.

Dr. H.P. Tipnis, Dean
Bombay College of Pharmacy
Kalina
Bombay 400098
India

R.W. Vanderwyk, Ph.D.
MA College of Pharmacy & Allied Health Sci.
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Prof. Geoffrey N. Vaughan
Dean
Victorian College of Pharmacy
381 Royal PDE
Victoria 3052, Australia

Dr. A.M. Veltman
Dept. of Pharmacy
U. of Durban-Westville
Private Bag X54001
Durban 4000
Rep. of South Africa

Richard J. Wald
College of Pharmacy
Univ. of Illinois
P.O. Box 6998
Chicago, IL 60680
U.S.A.

Dr. Vernon Walters
School of Pharmacy
Liverpool Polytechnic
Liverpool L3 3AF
England, U.K.

## PARTICIPANTS
**— continued —**

Victor D. Warner
Northeastern University
Coll. of Pharmacy &
Allied Health Prof.
360 Huntington Ave.
Boston, MA 02115 U.S.A.

Dr. Robert Wasicky
Faculde de Ciencias
Farmaceutics
Univ. de Sao Paulo
Caixa Postal 30.786
Sao Paulo, Brazil

Dr. Nate Watzman
Bureau of Health Prof.
Rm. 5-41 Center Bldg.
3700 East-West Hwy.
Hyattsville, MD 20782
U.S.A.

Dr. L.C. Weaver, Dean
College of Pharmacy
Univ. of Minnesota
Minneapolis, MN 55455
U.S.A.

Dr. Albert I. Wertheimer
College of Pharmacy
Univ. of Minnesota
Minneapolis, MN 55455
U.S.A.

Tommy Westerlund
College of Pharmacy
Univ. of Minnesota
Minneapolis, MN 55455
U.S.A.

Dr. Norman Westwood
School of Pharmacy
Leicester Polytechnic
Leicester LE1 9BH
England, U.K.

Robert O. White
MA College of Pharmacy
& Allied Health Sci.
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Dr. Jean Whitmore
College of Pharmacy
Rutgers University
P.O. Box 789
Piscataway, NJ 08854
U.S.A.

David A. Williams, Ph.D.
MA College of Pharmacy
& Allied Health Sci.
179 Longwood Avenue
Boston, MA 02115
U.S.A.

Dr. Beverley J. Wilson
School of Pharmaceutical
Sciences
Rhodes University
Grahamstown 6140
Rep. of South Africa

Ian Wiseman
Dept. of Pharmacy
Technikon
Private Bag 6011
Port Elizabeth
Rep. of South Africa

Harold H. Wolf, Dean
College of Pharmacy
University of Utah
Salt Lake City, UT 84112
U.S.A.

Dr. D.E. Wurster
College of Pharmacy
University of Iowa
Iowa City, IA 52242
U.S.A.

Jae Ick Yong, Ph.D.
College of Pharmacy
Sookmyung Women's U.
53-12 Chung-Pa Dong
Yong San-Gu
Seoul, Korea

Prof. Dr. A.F. Youssef
Dean
Faculty of Pharmacy
University of Assiut
Assiut, Egypt

Dr. Theodore B. Zalucky
College of Pharmacy
Howard University
Washington, DC 20059
U.S.A.

Leonard Zion
77 Atwood Avenue
Newton, MA 02160
U.S.A.

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